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LESSONS LEARNED IN USAF WEAPON
SYSTEM ACQUISITION MANAGEMENT:
A CASE STUDY APPROACH.

10 Leon-Girard R. Ketchum, ~~Captain~~, USAF
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This thesis presents 15 case studies that describe a number of the management problems that typically occur throughout weapon system acquisitions. Specifically, seven aspects of weapon system acquisition are addressed by the cases: procurement planning and selecting acquisition strategy, SPO personnel, managing program changes, support planning, managing total system integration, managing production and eliminating contract/hardware deficiencies, and transferring system responsibility. The cases are designed for classroom support use and contain introductory theoretical material, classroom procedure suggestions, an actual case, and instructor guidance.

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LESSONS LEARNED IN USAF WEAPON SYSTEM ACQUISITION MANAGEMENT: A CASE STUDY APPROACH

A Thesis

Presented to the Faculty of the School of Systems and Logistics

of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the Requirements for the

Degree of Master of Science in Logistics Management

By

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September 1976

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This thesis, written by

Captain Leon-Girard R. Ketchum

and

Captain Burton E. McKenzie

has been accepted by the undersigned on behalf of the faculty of the School of Systems and Logistics in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE IN LOGISTICS MANAGEMENT

DATE: 7 September 1976

John R. Adams
COMMITTEE CHAIRMAN

Martin D. Martin
READER

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CHAPTER 1

INTRODUCTION AND RESEARCH DESIGN

PROBLEM STATEMENT

Many of the "lessons learned" in the military logistics management area have not been documented in a manner useful for educating logistics managers (1; 15). Management of the weapon system acquisition process appears to be one area where such documentation would be especially useful (1; 5; 10; 15; 16). One approach to this documentation is to develop case studies illustrating recurring management problems in weapon system acquisition. These case studies could be designed for use in professional military education programs and in other academic instruction.

JUSTIFICATION

The Need for "Lessons Learned"

"Learn wisdom from the fortunes of others"--Tacitus (2).

Major weapon system[1] acquisitions have been characterized by cost escalations, cost overruns, and performance failures. The following are recent[2] examples:

C-5A: According to the Commission on Government Procurement, more than one half of the Air Force multimillion dollar C-5A aircraft were produced prior to completing ground tests and initial research and development (R & D) flight tests. Aircraft accepted by the Air Force accumulated 47 major deficiencies, of which 14 impaired the aircraft's ability to perform all or part of its 6 missions. For example, 3,300 landing gear malfunctions were reported during one 6-month period in 1971, requiring 83,000 maintenance manhours to repair. As a result of structural weakness within the aircraft wing, the life expectancy of the C-5A has been reduced from a planned 30,000 flying hours to about 7,000 flying hours (7:117). The cost

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[1]A "Major Weapon System" is designated by the Secretary of Defense to include those programs with an estimated R & D cost of $50 million or an estimated production cost of $200 million (27:1).

[2]"Recent" refers to the post 1961 time frame, the date Air Force Systems Command was established (4:127).

per C-5A aircraft escalated from $28.6 million to $56.0 million (9:52).

F-14A: The commission also reported that when the contract was let for the Navy's F-14A fleet air defense fighter, 134 aircraft were programmed to be in production or to be delivered before completing ground tests, preliminary flight tests, and inspections of the R & D aircraft. Once undertaken, preliminary flight tests (1972) disclosed 43 major deficiencies, including engine stalls, spin recoveries, and inadequate flight range (7:117-118). Senator Chiles testified before the Senate Appropriations Subcommittee that the final F-14A, when compared to original Navy specifications:

- was nearly 5,000 pounds overweight;
- missed its predicted 9.5 degree tail clearance angle by 5.1 degrees, thereby requiring a modified landing approach to preclude "tail bumping";
- missed its combat patrol endurance by 15 percent;
- missed targeted maintenance, reliability, and combat ceiling; and,
- managed to meet required ranges only after 2,000 pounds of fuel were added (6:7).

The cost per F-14A aircraft escalated from $8.7 million to $16.8 million (9:52).

B-1: According to Business Week, the Air Force B-1 strategic bomber, which, if procured, will replace the aging B-52, has already escalated from an estimated cost of $30 million per aircraft to a cost in excess of $80 million (13:78-79).

Being aware of, evaluating, and analyzing such weapon system acquisition experiences might help preclude costly acquisition management errors in the future. Identifying, documenting, and summarizing both successful and unsuccessful management efforts within the weapon systems acquisition process could provide a means for educating those who will manage the acquisition of future systems. The Air Force Systems Command (AFSC), whose purpose is "to provide sophisticated and technologically superior weapon systems for the national defense [3:64]," has recognized the need for documenting "lessons learned" and has encouraged the various AFSC Divisions to implement "lessons learned" programs. Major General Sylvester, Vice Commander of the Aeronautical Systems Division (ASD) of AFSC, outlined the purpose of the ASD Lessons Learned Newsletter in February, 1975:

> In an effort to improve the Acquisition Management process and to effectively translate the experience gained on past programs to management of our new programs, General Stewart, in March 1972, initiated a Lessons Learned Newsletter as a management tool for highlighting and disseminating this knowledge to our program offices and support activities [24].

Likewise, Major General Creech, Commander of the Electronic Systems Division of AFSC, wrote in June, 1975:

> An analysis of 1973 and 1974 reports again indicates that a continuing need exists for the Electronic Systems Division to improve the Acquisition Management Process. It takes us too long to identify problems; we have difficulty in reaching mutual agreement with all concerned in defining the specific cause of the problem; and, much too often the same problem repeatedly occurs, program to program, over the years. Through the principle of lessons learned we can overcome or at least reduce the repetitive type deficiencies [25:i].

While AFSC has recognized a need to document "lessons learned," its efforts have demonstrated shortcomings, particularly in obtaining candid reports of mistakes that have been made and in integrating the "lessons learned" programs of the various divisions within AFSC (10). In addition, none of the AFSC "lessons learned" efforts seem readily adaptable to an academic environment. They do not present the problem situation in the descriptive detail necessary for students to analyze alternatives and form their own solutions. The "lessons learned" do, however, indicate areas in which case studies might be developed.

Usefulness of the Case Method Approach

A case method approach to "lessons learned" in weapon systems acquisition management could prove useful in educating managers actually involved in the procurement process, as well as those individuals who eventually use and support those systems. Case studies would actually involve the student in a formal analysis of "real life" acquisition management experiences, thereby reenforcing the learning process (1; 15; 23; 28). These could be readily adaptable to courses in the School of Systems and Logistics and in the many

professional military education schools (1; 5; 15; 16). In addition, case studies would not necessarily require expensive or elaborate computer support, as do the simulations used by the Continuing Education Division of the School of Systems and Logistics, the Industrial College of the Armed Forces (ICAF), and the Defense Systems Management School (DSMS). Typically, simulations require a considerable amount of student time be applied to learning the necessary computer techniques, and participation is limited to those situations where the participants have relatively free access to computer facilities (16). Case studies would not levy this kind of a time and equipment requirement on the student; rather, he could devote his efforts to analyzing relevant management techniques. Case studies also offer the advantage that they could be used in correspondence courses as well as in residence programs.

Interviews with management instructors in the Graduate Education and Continuing Education Divisions of the School of Systems and Logistics revealed a need for case studies involving weapon systems acquisition management, particularly current ones, for use within both divisions (1; 5; 15; 16). Case studies reflecting current acquisition problems are also needed by DSMS to update the System X simulation (22:82). To appreciate how the case method can be applied to weapon systems acquisition management education, one should first be familiar with the weapon system acquisition process and the case method of instruction.

BACKGROUND

Weapon Systems Acquisition Defined

Weapon systems acquisition is a unique type of procurement because it usually involves "complex technologies, heavy costs, extended development, and relatively limited production quantities [14:42]." It has been defined by Peck and Scherer as "the conception, development, and production of technically advanced weapons for ultimate use by the armed forces [18:3]." Fox views weapon systems acquisition as essentially a two stage process: "The first stage includes planning, research, development, testing, and evaluation. The second stage is production [12:15]." The works of Fox and of Peck and Scherer thus view the acquisition process as ending with the production of the weapon system. However, there is a need to view the development and acquisition of major weapon systems as a "life cycle" process so that all factors of risk, cost, time, and support of the deployed system are brought into proper perspective (14:42).

In viewing weapon systems acquisition as a life cycle process, Bauer and Yoshpe identified some of the basic functions that are necessary for the development and acquisition of a weapon system. These include perception of need, design, production, and delivery (4:124).

> Briefly, "perception of need" involves consideration of enemy capabilities and the political situation; then a determination of what is desired, tempered with an evaluation of the current state of the art, a forecast

> of technical feasibility and consideration of economic factors. "Design" includes describing alternative solutions, developing designs, evaluating alternative solutions, and making the final selection. "Production" involves the facilities, manpower and other means for production, and assembly of components into final products. "Delivery" is the function of physically transferring a system from the producer to the user [4:124].

In the Department of Defense (DOD), acquisition has grown to mean the entire process of development, production, and deployment of a weapon system (14:42; 7:6). The life cycle of the acquisition process consists of five phases: conceptual, validation, full-scale development, production, and deployment (Figure 1 depicts the acquisition life cycle and briefly defines each phase). This life cycle view of the weapon systems acquisition process provides a basis for current DOD systems acquisition management (4:124; 26:1-1).

Evolution of Weapon Systems Acquisition Management

Until the early 1950's, there was basically a functional approach to weapons acquisition management. The practice was to develop and produce many system components and subsystems independently of their integrated use in a weapon system. This approach was possible because the design of many major weapon systems was sufficiently stable to permit components and subsystems to be readily integrated (7:7). However, the growth of advanced technologies, stimulated by the national defense needs of the Cold War environment, soon made the task of integration quite difficult (7:7). As a result, a new systems approach ("a comprehensive attack on a problem in the context of its environment [7:6]") to weapon

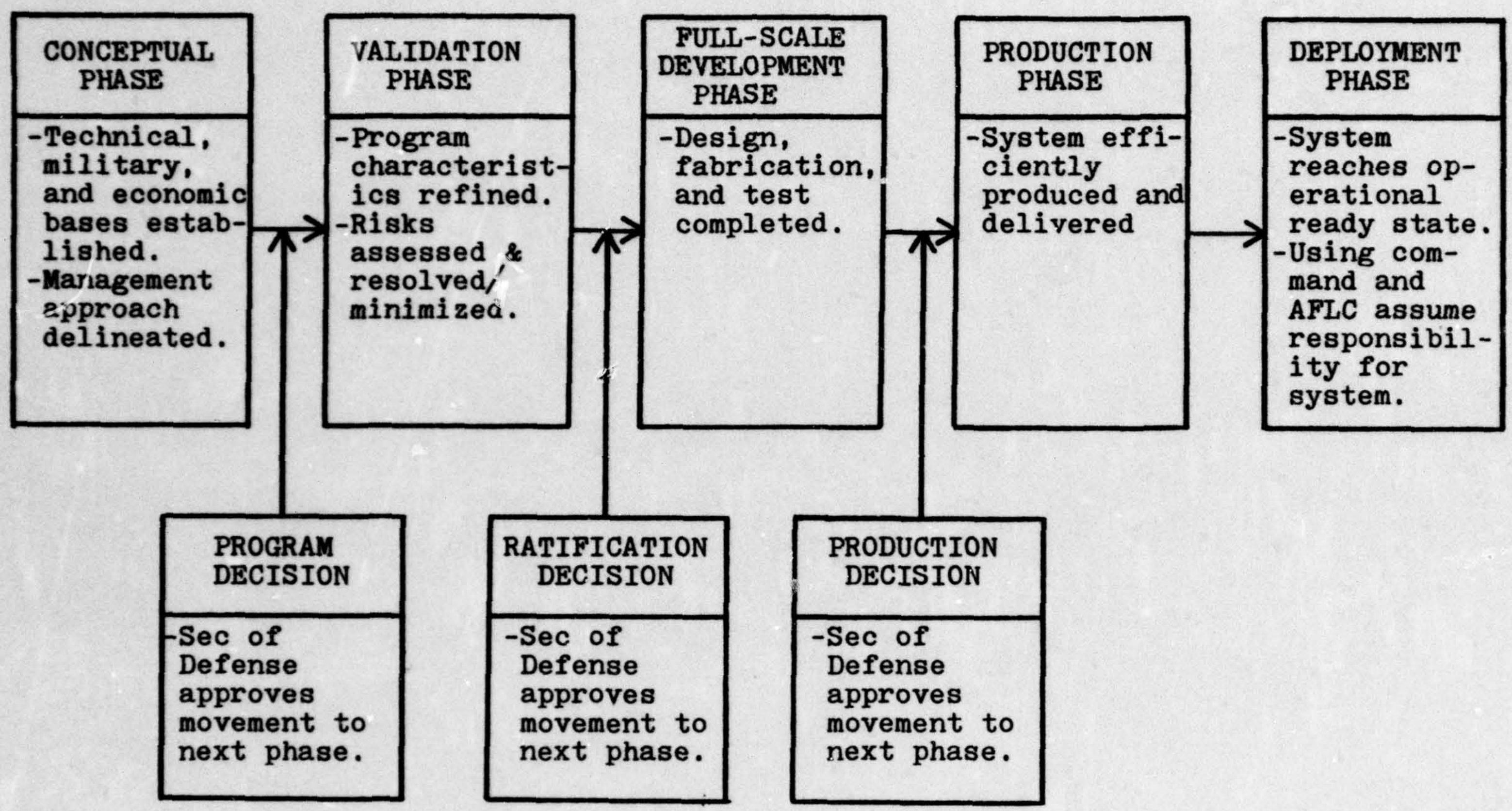

Figure 1

ACQUISITION LIFE CYCLE AND MAJOR PROGRAM DECISION POINTS
Source for definitions: AFSCP 800-3 (26:1-1--1-3)

systems acquisition management evolved (4:127; 7:6). This "systems approach" to weapons acquisition meant that a system would be designed, produced, and managed as an integrated unit instead of in a series of individual efforts (4:125). Coupled with the systems approach was the philosophy of program/project management.

The basic philosophy of project management is to centralize authority and responsibility for a program or project in a single individual (4:130). This individual is responsible for all planning, coordination, and the final outcome of the project (4:130).

> He is provided with a charter that defines explicitly his mission, role, authority, and resources and that permits his active participation in the major managerial and technical activities of the project [4:130].

All of the services used some form of project management in their early system management efforts (4:126-127). Initially, new systems management concepts were applied to a few select programs. These programs (Polaris for the Navy, Nike-Zeus for the Army, and Atlas for the Air Force) were selected based on the urgency of need and the complexity of the weapons systems (4:126). However, with the accelerating weapons technology and the increased cost and size of emerging programs, it became necessary for these management techniques to be applied to other programs. The Air Force was first to respond to these pressures and consequently the first to make changes in organization and management of its

weapon systems acquisition process in general (4:127).[3] By 1966, all three military departments had reorganized to align themselves to the new pattern of weapon system management within the DOD (4:127).

> The dominant characteristic of the new alignments was the use of vertical organizations of selected programs. These system oriented structures were headed by single managers empowered with the authority to direct their projects or systems through the several phases of development, procurement, and support. They had substantial control of necessary resources plus full-time staffs capable of positive direction of all organizational elements contributing to their projects. In contrast, under the earlier, so called functional management approach, total system integration could be achieved only in the person of the senior commander or bureau chief. These men had many systems to worry about, and were in no position to exercise the centralized direction and control modern weapon systems management required [4:129-130].

The systems approach, program management, and the life cycle nature of the weapons acquisition process were all incorporated in a 1971 DOD policy directive for major defense system acquisitions (27:1). This document establishes primary responsibility for major systems acquisition management with the individual service's program manager, but reserves final approval for transitioning through critical decision points in the acquisition life cycle to the Secretary of Defense (Figure 1 shows, in addition to the acquisition life cycle, these critical decision points). "The major emphasis is on management flexibility, cost effectiveness, and reduction of risk through hardware

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[3]For a history of Air Force acquisition management, see W. D. Putnam's <u>The Evolution of Air Force System Acquisition Management</u> (19).

proofing prior to a production commitment [26:1-1]." While this DOD policy directive has had a pervasive influence on DOD acquisition management, it has not provided a panacea for management problems.

Evolution of the Case Method

The case method of instruction was pioneered by Harvard University. In 1870, Christopher C. Langdell introduced a concept to the Harvard Law School for teaching law through the analysis of actual recorded legal cases (20:757). This concept of analyzing "real life" legal experiences became known as the "case method" and by the early 1900's had been adopted by virtually all law schools in the United States (20:757; 8:201).

The first catalogue of the Harvard Business School, issued prior to its opening in 1908, emphasized that the case method ". . . will be introduced as far as practicable [17:25]." The case method for the teaching of management and decision making proved extremely successful and is currently used almost exclusively at the Harvard Business School (23:37). Today the case method can be found in the curriculums of such diverse fields as law, medicine, business, social science, educational administration, and foreign service (11:114; 23:38).

Advantages of the Case Method

Perhaps the greatest advantage of the case method is its flexibility and adaptability (28:6). This flexibility

and adaptability is derived from the multiplicity of types of case studies and presentation/analysis techniques. It is not, therefore, surprising that various disciplines identify and coin cases representing and describing the techniques with which they are concerned. For example, David R. Willings' approach to applying the case method to management development and decision making instruction is to:

1. Identify the types of problems peculiar to management development and decision making;

2. Identify the various types of case studies appropriate to the previously identified problems; and,

3. Choose the alternative presentation/analysis techniques available to the instructor for presenting the case study (28).

Willings' approach is outlined in Figure 2 and is indicative of both the flexibility and adaptability of the case method.

Given the availability of relevant case material, there are a number of other advantages to the case method of instruction:

1. The case method is essentially student centered and requires the participant to develop and practice communication skills (11:11).

2. The case method requires a careful sifting of available facts and a realistic assessment of what is to be done; the participants are thereby forced to reason clearly and logically (11:11).

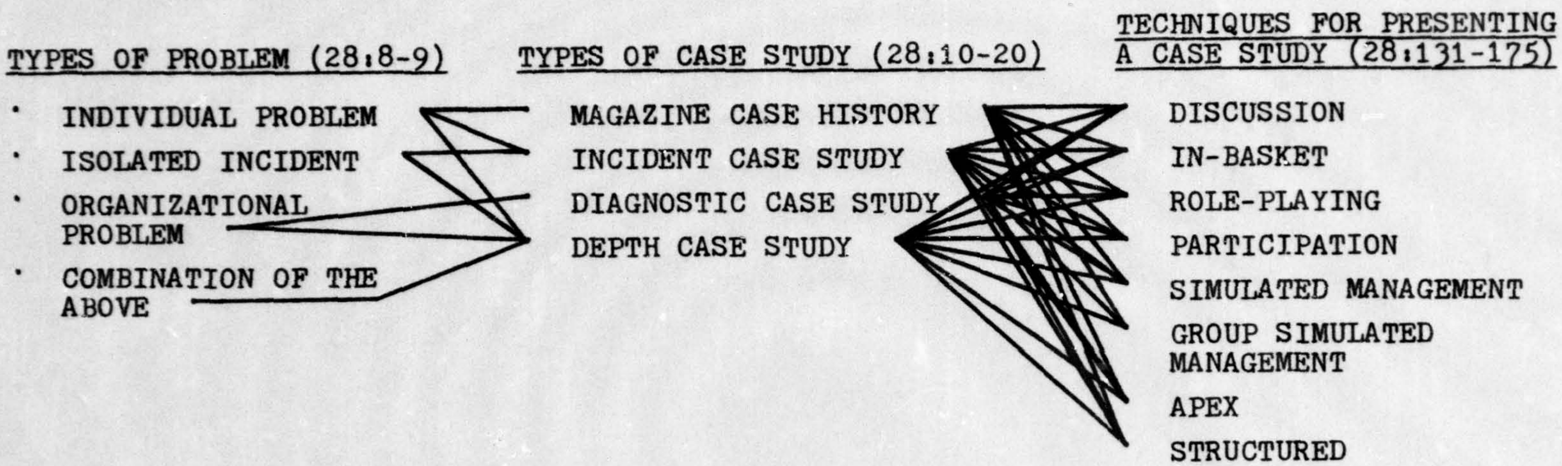

Figure 2

A CONCEPTUALIZATION OF THE CASE METHOD AS MIGHT BE APPLIED TO MANAGEMENT DEVELOPMENT AND DECISION MAKING INSTRUCTION (Connectors (——) depict possible combinations of problem——case study type——analysis technique.)

TYPES OF PROBLEM (28:8-9)

- INDIVIDUAL PROBLEM
  - Deals with one person's problem.
- ISOLATED INCIDENT
  - Deals with a problem which impacts on more than one person.
- ORGANIZATIONAL PROBLEM
  - Deals with a problem that impacts on the organization as a whole.
- COMBINATION OF THE ABOVE

TYPES OF CASE STUDY (28:10-20)

- MAGAZINE CASE HISTORY
  - Case is concerned with the individual who is the subject of the case study. Details of the organization and technical data are only given where they are necessary to give adequate background to the subject indicidual.
- INCIDENT CASE STUDY
  - Case is used to describe an isolated incident. May be possible to present the same problem as either an incident case study or a magazine case history.
- DIAGNOSTIC CASE STUDY
  - Case is used to solve organizational problems. All relevant data concerning the company and the individual within the company are given.
- DEPTH CASE STUDY
  - Case is used for problems which are a combination of all three types of problem. Diagnosis and prescription are of equal importance.

TECHNIQUES FOR PRESENTING THE CASE STUDY (28:131-175)

- DISCUSSION
  - Instructor is the discussion leader for a class effort to analyze the case.

Figure 2 (continued)

A CONCEPTUALIZATION OF THE CASE METHOD AS MIGHT BE APPLIED TO MANAGEMENT DEVELOPMENT AND DECISION MAKING INSTRUCTION

- IN-BASKET
  - Stresses written communication. Case study outlines a problem and contains an organizational chart with biographical details of study characters. Students sort out problems by means of memos to personnel listed on the organizational chart.

- ROLE-PLAYING
  - A member of the student class is required to conduct an interview with a role player briefed to impersonate an employee with a specific problem.

- PARTICIPATION
  - Is a reversal of role-playing technique. Student assumes role of character described in the case study and either the instructor or a briefed student interviews him. Allows the manager to put himself into the experience of another person.

- SIMULATED MANAGEMENT
  - Student is assigned the role of general manager. Details of organizational structure/relevant personnel are supplied in a depth case study. Students and/or instructors assume roles of relevant organizational personnel and retire to separate rooms. Throughout this technique, problems are presented for their resolution by memo, telephone call, and briefed participation by other students.

- GROUP SIMULATED MANAGEMENT
  - Student class is divided into subgroups to independently analyze various specified aspects of a problem presented by a case study.

- APEX
  - A depth case study is selected for analysis by student subgroups. Subgroups are selected so that the case study closely relates to their real-life jobs. Objective is to sensitize students to factors in their own jobs that motivate or frustrate them and to relate their reactions to their own staff and their day-to-day management.

- STRUCTURED
  - Objective is the objective evaluation of problems vice emotional involvement. Student role-players assume scripted roles with which to analyze case presented problems.

Figure 2 (continued)

A CONCEPTUALIZATION OF THE CASE METHOD AS MIGHT BE APPLIED TO MANAGEMENT DEVELOPMENT AND DECISION MAKING INSTRUCTION

3. The case method teaches the participant to think in the presence of new situations (17:3).

Disadvantages of the Case Method

Perhaps the primary disadvantage of the case method lies not with the method itself, but with the instructor employing the method. The method inherently requires the instructor to carefully prepare for a particular case analysis (11:11-12). Erroneous selection of (1) the problem to be emphasized, (2) the related case to be analyzed, or (3) the appropriate presentation/analysis technique can be disastrous in the classroom. This obstacle could be reduced by providing the instructor with a comprehensive, properly structured guide which would include suggested presentation techniques, discussion guides, and suggested case solutions.

The Case Method and Weapon System Acquisition Management

J. R. Kidd made the following observation of the case method (11:14):

> . . . what makes a particular case useful is its reality, its relevance to problems faced by others, the completeness of available data, and the significance of the issues or values at stake . . . . The case method has application particularly to fields where there are few or no final answers, and where judgment is the essential quality . . . .

The weapon system acquisition process is extremely complex. The manager must deal with a dynamic environment shaped by technical, economic, military, and political forces (14:40). This environment prevents the use of a

single method of management, or the use of textbook solutions to solve its problems (21:4; 22:81). It is indeed one of those fields where "there are few or no final answers." Therefore, the case method, with its inherent flexibility, adaptability, and relevance, seems ideally suited to present and analyze "lessons learned" in weapon system acquisition management.

OBJECTIVE

The purpose of this research is to develop case studies that depict management problems typically encountered in the weapon system acquisition process. These case studies are designed and formatted for use primarily in professional military education schools, but should also be useful in other academic instruction efforts.

SCOPE AND LIMITATIONS

This research was limited primarily to Air Force weapon system acquisition programs managed by ASD. This was due to the fiscal and time constraints involved with the research effort as well as the interests and backgrounds of the researchers. The research was restricted to the System Program Office (SPO) life cycle and its role in the weapon system acquisition life cycle. The only significant time difference between the SPO life cycle and the acquisition life cycle is that the deployment phase of the acquisition life cycle extends beyond the life of the SPO.

Thus, the research will focus on those acquisition management problems typically encountered during the life cycle of the SPO.

ORGANIZATION OF THE RESEARCH

This first chapter has addressed the problem statement, justification, and background for this research. The research objective and the scope and limitations of the study were also covered.

Chapter 2 covers the methodology used in performing the research.

Chapter 3 covers the research findings and provides recommendations for future research. The case studies that were developed can be found in Appendices B-H. They were placed there so that they could be accessible to anyone who wanted to use them.

CHAPTER 2

METHODOLOGY

The basic approach for conducting the research is outlined below:

A. First, recurring management problems associated with the various phases of the weapon system acquisition process were identified. Related problems were collected into groupings which were later to be addressed by case studies.

B. Next, a data base was established by identifying Air Force acquisition programs which had experienced these problems. From this data base, relevant data was collected and analyzed to determine the type of case studies that would be used to address these problems.

C. As the final step, case studies were developed from this data.

Problem Identification

To identify recurring acquisition management problems, a survey was made of instructors in the School of Systems and Logistics, Air Force Institute of Technology. These instructors either taught courses related to weapon systems acquisition management and/or had prior experience with weapon system acquisitions (see Appendix A for

information concerning these instructors' credentials). A basic list of problems, by phase, was obtained from one of the instructors who taught courses in weapon systems acquisition management. This list was then circulated among the other instructors for further suggestions and refinements. The resulting composite list of problems encountered in each of the phases of the acquisition process is shown in Figure 3.

An analysis of Figure 3 revealed that many of the problems were not unique to a single phase of the acquisition life cycle. For example, procurement planning, cost negotiation, and coping with uncertainty were problems listed in several phases of the life cycle. Attempts to group related problems within each phase and address each problem grouping with a case study would be repetitious and time consuming. To make the research effort more manageable and still develop cases covering the acquisition life cycle, the problems associated with each phase of the acquisition process, shown in Figure 3, were selected and grouped according to general nature of the problem as shown in Figure 4. Figure 5 shows where these problem groupings might typically occur in the acquisition life cycle. The resulting seven groupings define the areas in which case studies were developed.

Data Identification/Collection

The initial phase of data collection consisted of identifying acquisition programs that had experienced the problems outlined in Figure 4. Four possible sources were

CONCEPTUAL PHASE	VALIDATION PHASE
-Defining the requirement -Coping with uncertainty -Cost estimation -Determination of test requirements -Procurement planning -State-of-the-art factors -Selection of Program Office personnel -Estimating life cycle costs	-Selection of acquisition strategy -Management of program change -Contractor capability assessment -Cost estimation -Proposal evaluation -Cost negotiation -Evaluation of uncertainty -Source selection criteria -Mission capability assessment -Trade-off analysis -Establishing design-to-cost goals -Test and evaluation planning

Figure 3

RECURRING WEAPON SYSTEM ACQUISITION MANAGEMENT PROBLEMS

FULL-SCALE DEVELOPMENT	PRODUCTION PHASE
-Procurement planning -Refinement of specifications -Evaluation of test results -System integration -Cost control -Management of changes -Political influences -Source selection -Cost negotiation -Uncertainty analysis -Criteria for production readiness review -Contractor motivation -Planning for program management responsibility transfer -Responding to "What if's?" -Support planning -Budget perturbations -Warranties	-Source selection -Cost negotiation -Management of changes -Management of government furnished equipment -Quality determination -Production scheduling -Scarce/critical material acquisition -Proposal evaluation -Provisioning schedule -Lack of price competition -Cost control -Non-conforming supplies -Behavioral problems -Economic environment (inflation) -"Tiger Team" formation

Figure 3 (continued)

RECURRING WEAPON SYSTEM ACQUISITION MANAGEMENT PROBLEMS

DEPLOYMENT, OPERATIONS, AND DISPOSITIONS
-Eliminate the System Program Office -Interface among AFLC, ATC, and using command -Scheduling hardware turnover -Eliminating contract/hardware deficiencies -Contract closure -Final price negotiation -Engineering change negotiation -Configuration control -Support interface agreements -Product improvement program

Figure 3 (continued)

RECURRING WEAPON SYSTEM ACQUISITION MANAGEMENT PROBLEMS

I. PROCUREMENT PLANNING & SELECTING ACQUISITION STRATEGY
- -- Coping with uncertainty
- -- Estimating cost
- -- Determining test requirements
- -- Determining state-of-the-art factors
- -- Evaluating contractors' proposals
  - -- Assessing contractor's capability
  - -- Evaluating contractor's cost estimation
  - -- Negotiating

II. SYSTEM PROGRAM OFFICE PERSONNEL
- -- Selecting personnel
- -- Interpersonal relations

III. MANAGING PROGRAM CHANGES
- -- Changing mission capability requirements
- -- Performing trade-off analysis
- -- Changing requirements
  - -- Quantity changes
  - -- Specification (cost vs performance) changes
  - -- Production schedule changes
- -- Impacting political, social, and economic (inflation, budget) forces

IV. SUPPORT PLANNING
- -- Designing prime equipment for maintainability
- -- Designing and procuring support equipment

V. MANAGING PRODUCTION
- -- Acquiring scarce/critical materials
- -- Managing government furnished equipment

VI. MANAGING TOTAL SYSTEM INTEGRATION & ELIMINATING CONTRACT/HARDWARE DEFICIENCIES
- -- Controlling configuration
- -- Negotiating engineering change

VII. TRANSFERRING SYSTEM RESPONSIBILITY
- -- Scheduling hardware turnover
- -- Interfacing among AFLC, ATC, and using command
- -- Managing support interface agreements
- -- Eliminating the System Program Office

Figure 4

GROUPING OF ACQUISITION MANAGEMENT PROBLEMS

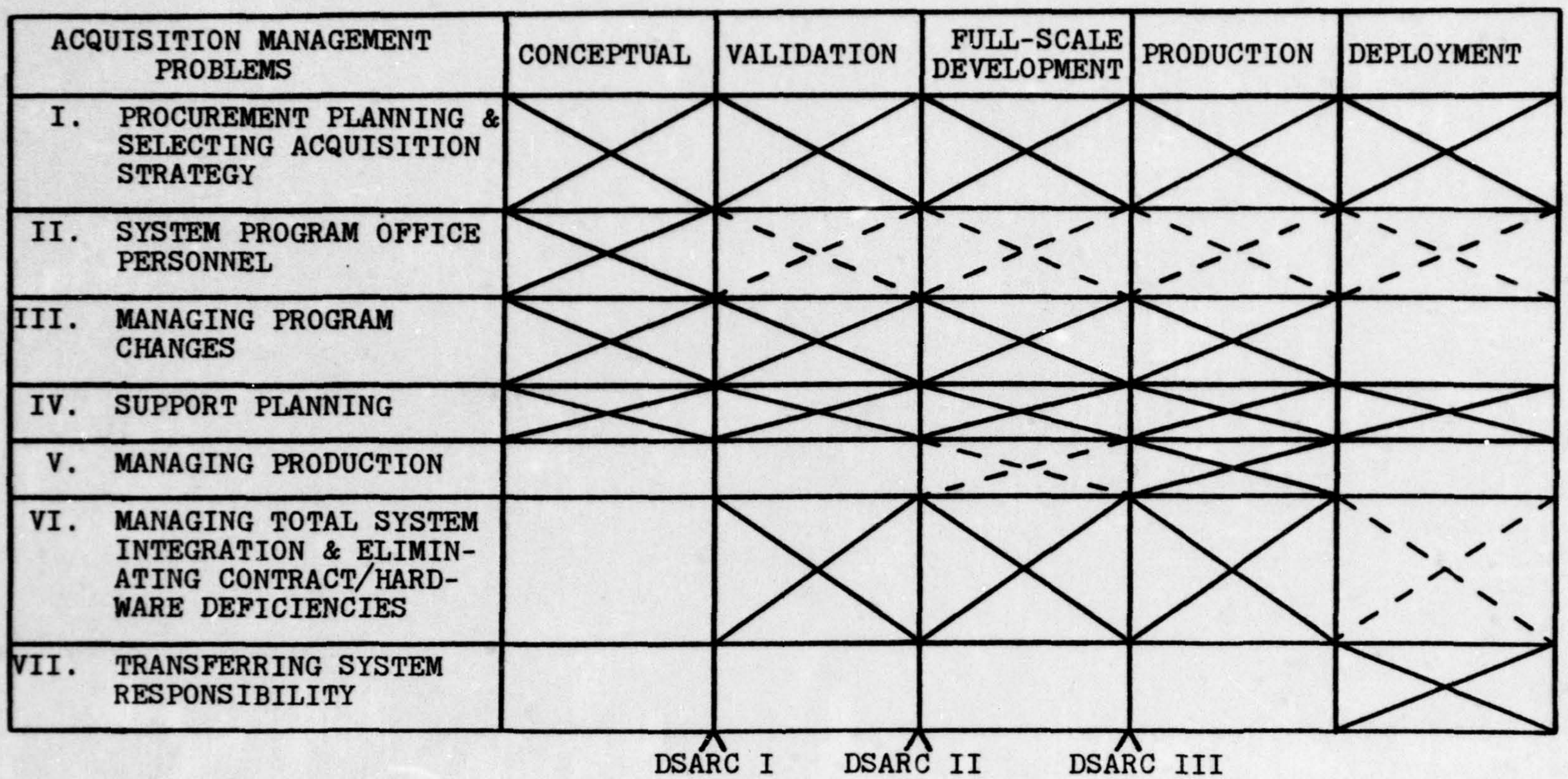

Figure 5

MATRIX RELATING PROBLEMS WITH ACQUISITION LIFE CYCLE

...Indicates phases in which identified problems "typically" occur.

...Indicates phases in which identified problems can occur, but impact the system acquisition to a lesser extent than the "typical" occurrence.

identified which, in combination, provided the data base from which the case studies were developed:

1. System Program Offices within the Wright-Patterson Air Force Base (WPAFB) complex that were willing to cooperate in the research effort;

2. Instructors' files of researched case studies in the weapon system acquisition management area;

3. Previous School of Systems and Logistics thesis efforts relating to specific weapon system acquisition programs or acquisition management problems; and

4. Major research papers and thesis efforts on weapon system acquisition management developed at other DOD professional schools.

The literature comprising the latter three data sources was reviewed to determine if it contained information pertaining to the problems under study. Those relevant theses or case studies were matched to the problem groupings they best exemplified. For example, a thesis on the Total Package Procurement strategy used for procuring the C-5 transport could have provided data for a case in the problem area "Procurement Planning/Selecting Acquisition Strategy."

Since current data was needed which would make the case studies more relevant (1; 5; 15; 16; 22), SPO's within the WPAFB complex were contacted for information relating to these problem areas. Initial telephone contact with SPO personnel established if a particular SPO was willing to cooperate in the research effort. If willing to cooperate,

an interview with mid-level and senior SPO managers was scheduled to identify what types of problems the acquisition program had encountered. Figure 4 was used to focus the questioning to those problems encountered which would be relevant to the research. Once it was ascertained that the program had encountered a particular problem of interest, an inquiry was made to determine the existence of written documentation or the availability of personnel familiar with the problem. Information obtained from existing program documentation and interviews served two functions: (1) it frequently verified the currency of data found in secondary sources, which could be easily adapted into case formats; and (2) when it provided more current data, it served as the primary data source for developing the case studies.

The second phase of data collection consisted of analyzing the relevant data pertaining to each problem grouping to determine what type of case (Figure 2) could be developed. The extent and type of data available determined what type of case study would be most appropriate. When several programs experienced similar problems, the documentation from each program was analyzed to determine what data would be used to support a particular case. Since the focus of the research was on problems rather than particular acquisition programs, information from several sources was sometimes integrated and used in a single case. Case studies developed from programs still in being do not

reflect the source of the information; fictitious program names were used to provide the necessary anonymity.

Case Study Development

The case method's inherent advantage lies in its flexibility and adaptability (28:6). Figure 2 depicts some of the possible combinations of types of problem, types of case study, and techniques for presenting case studies. The type of case study (magazine, incident, diagnostic, depth) to be constructed was determined by the amount and detail of useable data that could be developed from identified data sources. For example, a graphic instance illustrating a particular problem dealing with managing program changes might be well documented within a specific SPO; this problem might lend itself to an incident case study. Alternatively, the problem area of selecting acquisition strategy might lend itself to a depth case study.

As a minimum, case studies were designed and constructed within a format including the following sections, as applicable to the type of case study selected:

1. Introduction. The introduction addresses the instructor and generally presents the problem(s) illustrated and points relating to management theory which may be exemplified by the case.

2. Suggested Class Procedure. This section contains recommended presentation techniques (discussion, role-playing, etc.), the estimated time required for student

preparation, the estimated class time required for the presentation, and class procedures for conducting the case.

3. Case. The case includes a specific, detailed description of the environmental setting in which the problem(s) occur, variables affecting the problem(s), and the problem situation(s) itself. When applicable, it also includes roles, discussion techniques, and procedures to be used by the student in analyzing the case, and discussion questions designed to cause a thoughtful analysis.

4. Instructor Guidance. The instructor guidance addresses issues to aid the instructor in obtaining maximum use of the case. Depending on the type of case, it includes a summary (if available) of the solution actually employed in the situation represented by the case, suggested alternative solutions to the problem(s) presented within the case, possible outside reading assignments, a list of discussion questions designed to draw out and emphasize the case objective, and a summary to use as closing comments.

CHAPTER 3

FINDINGS AND RECOMMENDATIONS

Findings

The objective of this research was to develop case studies depicting typical management problems encountered in the weapon system acquisition process. In the process of meeting that objective, typical management problems were identified, data gathered, and case studies developed in accordance with the methodology described in Chapter 2. The case studies that were developed are included as Appendices B-H.

A majority of the data used in developing these cases came from existing documentation that was not in the case study format. Thus, a major part of the research effort involved transforming existing data into a case study format useful for classroom instruction. Data gathered from primary sources, i.e., existing SPO's, was used in some case studies, but it served primarily as corroborating evidence that similar problems are encountered from program to program. The method of dealing with acquisition management problems may differ, but the problems themselves seem to remain essentially the same.

Developing the case studies proved to be a rewarding but frustrating experience. It was rewarding to the extent that it provided new insight into the various problems of weapon system acquisition. The frustrating aspect was that not enough time could be spent on any one area to get an in-depth knowledge of the associated problems. An entire research effort could have been devoted to some of these areas, e.g., "Transferring System Responsibility." Despite the frustrations, the overall objective of the research was met.

Recommendations for Future Research

Although the objective of this research was met, the effort is far from complete. The scope of the weapon system acquisition process is so broad that only a small portion was covered by this research. Even though an attempt was made to cover the entire weapon system acquisition life cycle, the case studies that were developed did not cover all of the identified problem areas. Future research is needed to fill in the gaps as well as provide greater depth into the areas that were covered. As long as the Air Force is in the business of providing national defense, there will be a need for weapon system acquisition management. Therefore, research into this area to provide "lessons learned" will remain a timely and worthwhile endeavor.

APPENDICES

APPENDIX A

BIOGRAPHICAL SKETCHES

APPENDIX A

BIOGRAPHICAL SKETCHES

Four instructors at the School of Systems and Logistics, Air Force Institute of Technology were surveyed for a listing of recurring management problems in the weapon system acquisition process. Their biographical sketches, in alphabetical order, follow:

-- Lieutenant Colonel (L/C) John R. Adams, B.S., M.B.A., Ph.D. L/C Adams is an Assistant Professor of Organization and Management Theory in the Management Studies Department, Graduate Education Division, School of Systems and Logistics, Air Force Institute of Technology. His Air Force experience has included duty in missile maintenance (Titan I Site Maintenance Officer and Maintenance Supervisor); in research and development (Facilities Supervisor and Chairman of the Facilities Working Group in the Titan III Systems Program Office); in major command headquarters (Staff Project Officer (Command and Control), Future Systems Plans, Headquarters Strategic Air Command); and, in education (Curriculum Manager and Instructor, Squadron Officers School and Air Force Institute of Technology).

-- Lieutenant Colonel (L/C) Stephen E. Barndt, B.S., M.B.A., Ph.D. L/C Barndt is an Assistant Professor of Management in the Research and Communicative Studies Department, Graduate Education Division, School of Systems and Logistics, Air Force Institute of Technology. His Air Force experience has included duty in missile operations (Launch Officer and Instructor); in radar operations (Interceptor Controller and Operations Officer); and, in research and development (Assistant Program Manager, Study Manager, and Project Officer for a major future system planning effort).

-- Dyke McCarty, B.S., M.B.A. Mr. McCarty is an instructor in the Logistics/Systems Integration Department, Continuing Education Division, School of Systems and Logistics, Air Force Institute of Technology. Mr. McCarty has held supervisory positions in Air Force Program Offices managing the research, development, test, evaluation, and acquisition of Air Force weapon systems. Since his retirement from the Air Force in 1971, he has served as a faculty member of the Ohio State University Defense Management Center. Mr. McCarty is currently Course Director for the Financial Management in Weapon Systems Acquisition. He

lectures in the areas of acquisition management, integrated logistics support, and life cycle costing.

-- Lieutenant Colonel (L/C) Martin D. Martin, B.S., M.B.A., Ph.D. L/C Martin is an Associate Professor of Logistics Management in the Management Studies Department, Graduate Education Division, School of Systems and Logistics, Air Force Institute of Technology. His Air Force experience has included duty in procurement (Procuring Contracting Officer); in contract administration (Chief of Management Engineering, Assistant Chief, Office of Planning and Management, and Chief of a Defense Contract Administration Services Office); and, in procurement management (Procurement Management Staff Officer in the area of weapon system acquisition and procurement pricing policy, Headquarters, Air Force Systems Command).

APPENDIX B

PROCUREMENT PLANNING AND SELECTING ACQUISITION STRATEGY

APPENDIX B

TABLE OF CONTENTS

I. INTRODUCTION

I. INTRODUCTION

Certainty, Risk, and Uncertainty

The concepts of certainty, risk, and uncertainty are not easily understood, particularly as they apply to the weapon systems acquisition process. Simplistically, certainty implies complete knowledge or information; risk implies partial knowledge or information; and, uncertainty implies the absence of knowledge or information. One approach to presenting the relationship between certainty, risk, and uncertainty is depicted in Figure B.1. Certainty and uncertainty are seen as occupying the extremes of a continuum; risk is seen as a degree of uncertainty.

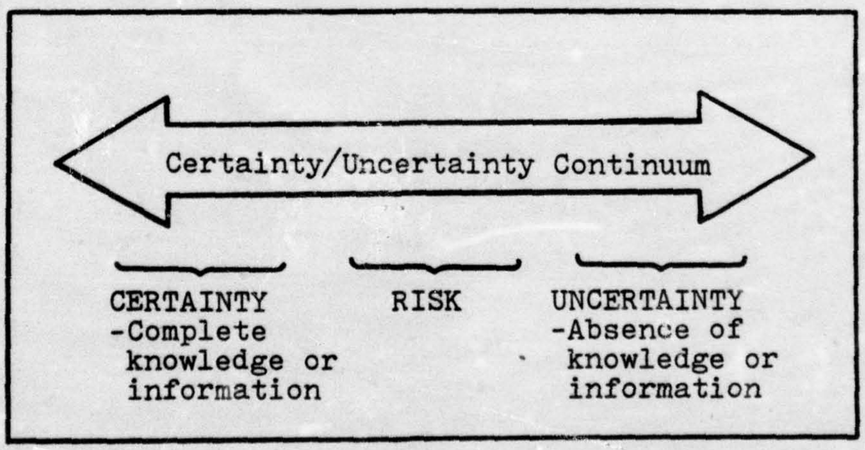

Figure B.1
CERTAINTY/UNCERTAINTY CONTINUUM

Martin[1] classifies various terms describing types of uncertainty into four taxonomic classes: environmental, functional, informational, and technical. His taxonomy is presented at Table B.1 to illustrate various perceptions of uncertainty.

It is interesting to note that theoretical or technical perceptions of risk imply that probabilities can be assigned to future events. Uncertainty exists when the probabilities cannot be assigned to future events. The manager usually intuitively assigns subjective probabilities to the occurrence of future events in an attempt to move from a position of uncertainty with respect to the certainty/uncertainty continuum (Figure B.1) to a position of risk. His ultimate goal would be to move to a position of certainty; i.e. he would like to make decisions in the presence of complete knowledge or information.

Unfortunately, the manager rarely, if ever, finds himself in a position of certainty. This is particularly true in the case of the manager of a weapon system acquisition. Uncertainty is a pervasive feature of all economic activity. There is a uniqueness, however, in both the magnitude and the diverse sources of uncertainty in a weapon system acquisition.

---

[1]Martin Dean Martin, "A Conceptual Cost Model for Uncertainty Parameters Affecting Negotiated, Sole-Source, Development Contracts" (unpublished Doctoral dissertation, The University of Oklahoma, 1971), pp. 40-43.

Table B.1[2]

UNCERTAINTY TAXONOMY

Description		Comment	
Environmental:			
1a.	Nature	1a.	The uncertainty is related to natural factors, such as storms and floods.
b.	Social and Political	b.	The term relates to the impossibility of being able to predict with any precision the actions of social and political groups.
c.	Communication Media	c.	The disparities that exist in the access which people have to the various informational media. The differences result in ignorance on the part of many groups and individuals.
d.	Time	d.	The passage of time results in changes which can distort the results of decisions based on a past state-of-affairs.
2a.	External	2a.	These uncertainties relate to factors external to a project which can impinge on final results.
b.	Internal	b.	Internal uncertainties comprise those stemming from the technical approach taken, etc.
3a.	Exogenous	3a.	The stimulus, initiating a given change comes from outside the organization.
b.	Endogenous	b.	The stimulus, initiating the change, originates within the organization.

[2] Martin, pp. 41-43.

Table B.1 (continued)

Description	Comment
Functional:	
1a. Business Risk	1a. The firm is uncertain about its future income stream. The risk is associated with the firm's operation.
b. Financial Risk	b. The uncertainty is generated by the ratio of debt to equity in the capital structure. The amount of earnings available to common stockholders. For contracting the risk of profit or loss on an individual contract is involved.
c. Technological Uncertainty	c. Changes in the state-of-the-art can render a weapon obsolete. Thus, uncertainty exists as to how long a weapon can remain in the operational inventory.
d. Production	d. Most products represent an integration of component parts. Should a part not be available, then the finished product cannot be ready on time and even its cost can be affected.
Informational:	
1a. Anticipated Unknowns	1a. The unknowns in this class are those that a contractor is aware of. The problem area is anticipated.
b. Unanticipated Unknowns	b. These unknowns cannot be foreseen.
2a. Known Unknowns	2a. The facts the contractor knows that he does not know.
b. Unknown Unknowns	b. The unknowns the contractor does not anticipate.

Table B.1 (continued)

Description	Comment
Technical:	
1a. Uncertainty	1a. The known is completely dominated by the unknown. The probability distributions for future events are not known.
b. Risk	b. A decision leads to one of a specific number of well defined alternatives. The totality of outcomes for a given variable can be described by a probability distribution.
c. Certainty	c. Each decision leads to a predictable outcome. No doubt as to the final outcome is possible.
2a. Subjective	2a. The term relates to the probabilities assigned to an event and which are wholly based on the observation choice.
b. Objective	b. These probabilities are derived by specific procedures independent of the problem being confronted.

The Contract and Uncertainty

The contract, within the context of weapon system acquisitions, offers a convenient focal point for analyzing and illustrating uncertainty--environmental, functional, informational, and technical--that the manager must cope with. Essentially, a contracting relationship exists when a contractor agrees, for a stated amount of money, to deliver to a government agency a product with a specified performance, at a specific time, and in a stated quantity.

The contract price agreed upon between the contractor and the government agency is based on estimates of future cost (environmental and functional uncertainty). These estimates are made from positions of risk and uncertainty along the certainty/uncertainty continuum (Figure B.1) and may result in considerable error, which is often translated into cost growth or escalation. The more ambiguous the specifications for a product or service being contracted for (informational uncertainty), the greater the chance for error or cost growth. Ambiguous specifications are often the case when technological state-of-the-art parameters are being expanded (technical uncertainty).

Uncertainties exist, therefore, relative to weapon system acquisition program costs, technical performance and reliability of the weapon system, and delivery dates of the weapon system. Various unpredictable (uncertain) forces--political, economic, social, technological--impact the acquisition throughout its life cycle. Contracts are

awarded through the acquisition life cycle of the total weapon system (see Figure B.2).

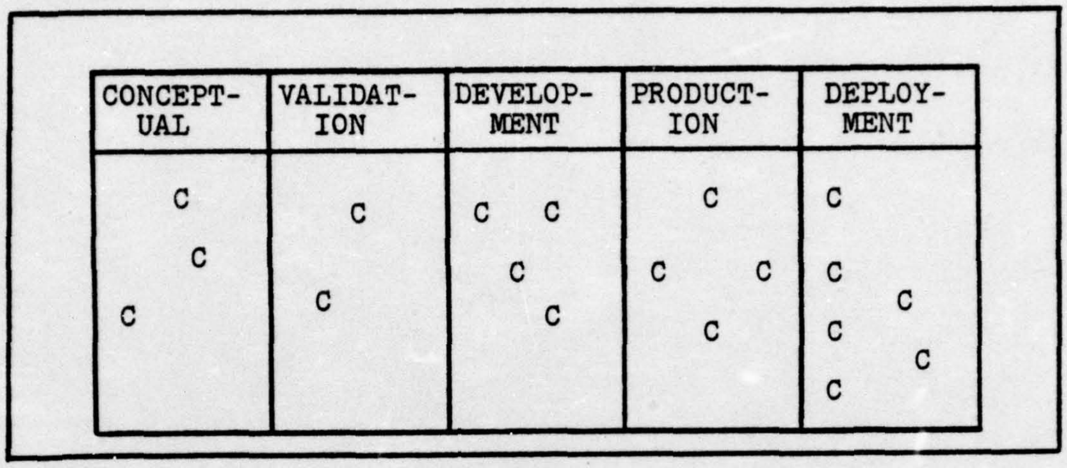

Figure B.2

CONTRACTS ARE AWARDED THROUGHOUT THE WEAPON SYSTEM ACQUISITION LIFE CYCLE

C = Contract Award

The contract life cycle might be conceptually viewed as consisting of three phases: pre-award, contract award, and post-award. When viewed over time (see Figure B.3), uncertainty is greatest during the pre-award phase of the contract life cycle. During the pre-award phase the manager attempts to translate uncertainty into risk and certainty. At the point of contract award, uncertainties still exist. To a large extent, the success of the contract (meeting program cost estimates, performance and reliability objectives, and delivery dates) results from the manager's ability to reduce uncertainty during the pre-award phase of the contract life cycle. During the post-award phase of

the life cycle, the manager must cope with the reduction of uncertainty as the product or service is completed or performed.

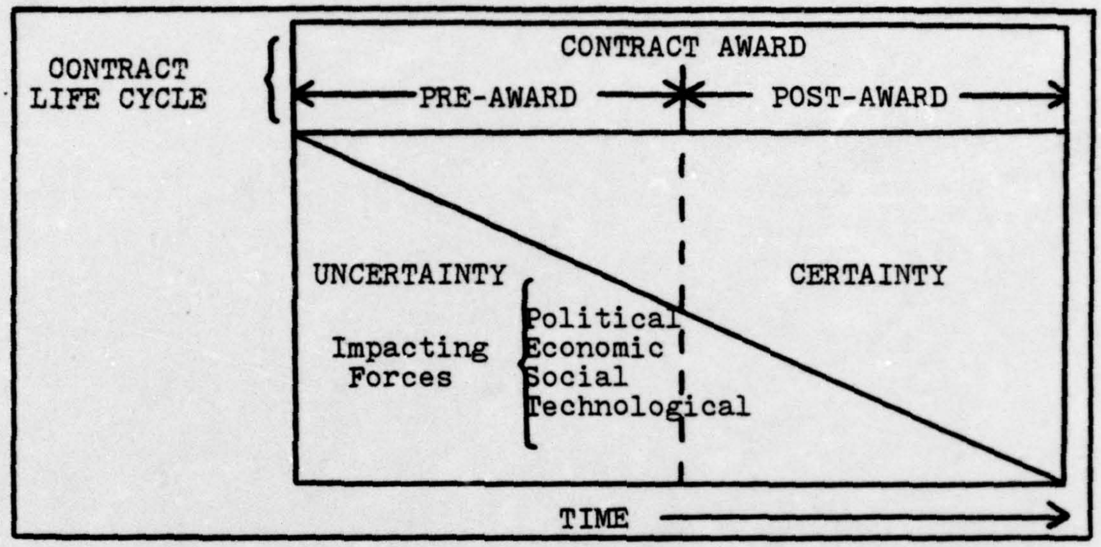

Figure B.3

UNCERTAINTY IS REDUCED OVER TIME WITH RESPECT TO THE CONTRACT LIFE CYCLE

Procurement Planning and Acquisition Strategy

Procurement planning is critical to the acquisition. Within the context of the contract life cycle, the majority of the procurement planning effort takes place during the pre-award phase and deals with the reduction of uncertainty, the estimation of acquisition program costs, the specification of performance and reliability characteristics, and the establishment of delivery dates.

The selection of the acquisition strategy, in essence, is the determination of the negotiating position. Generally speaking, major weapon systems are procured from a sole-source contractor. In this situation, the contractor

is a monopolistic seller and the Government is a monopsonistic buyer. During the contract negotiations, variables such as contract price, type of contract, product specifications, and delivery dates are examined and agreement is reached. Contract price is an aggregate of manhour, material, equipment, and indirect cost estimates. Cost growth may well result from a variance in any one of these estimates. The type of contract negotiated may well determine whether the Government or the contractor assumes the risk of coping with the uncertainties of the acquisition. Figure B.4 presents a conceptualization of contract types arranged

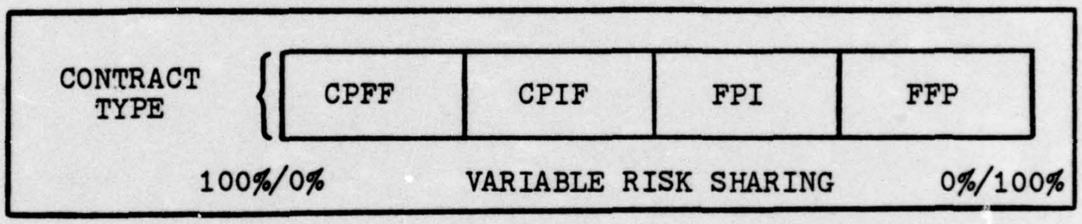

Figure B.4

CONCEPTUALIZED SPECTRUM OF RISK SHARING
100%/0% = Government Risk/Contractor Risk

on the risk spectrum. In the CPFF (cost-plus-fixed-fee) contract, the Government pays contract performance costs and guarantees a fixed profit to the contractor; the Government, therefore, accepts 100 percent of the risk of contract performance. In the FFP (firm-fixed-price) contract, the Government pays a fixed price for contract performance; the contractor, therefore, accepts 100 percent of the risk of

contract performance. In the CPIF (cost-plus-incentive-fee) and the FPI (fixed-price-incentive) contracts, both the Government and the contractor negotiate a risk-sharing ratio. Contracts differ in (1) the degree and timing of responsibility assumed by the contractor, and (2) the amount and kind of profit incentive offered the contractor to achieve or exceed specified standards or goals. Generally speaking, the CPFF contract is prevalent in the early phases (see Figure B.2 of the weapon system acquisition life cycle, and the FFP is prevalent in the latter phases of the life cycle. This transfer of risk from the Government to the contractor occurs as the weapon system evolves from the highly uncertain state (environmental, functional, informational, and technical) of the conceptual phase of weapon system development to the relatively certain states of the production and deployment phases of weapon system development.

The Cases

Four cases are presented to introduce the student to various aspects of uncertainty with which the manager "typically" must cope in the context of weapon system or subsystem acquisitions. Certainly the uncertainties and risks associated with contracting are not all-inclusive. The contract does provide, however, convenient situational study. The four cases contained in this section are outlined below.

<u>"The Sting" Case</u>

This case focuses on the use of the SHOULD COST concept for the reduction of and coping with uncertainty with respect to determining a favorable Government contract negotiating position and evaluating:

-- contractor's cost estimates;

-- contractor's ability to meet delivery schedules; and,

-- application of learning curves.

<u>"The Widget" Case</u>

This case focuses on the reduction of and coping with uncertainty with respect to determining and evaluating:

-- industry state-of-the-art;

-- contractor's cost estimates;

-- contractor's ability to meet delivery schedules; and,

-- cost/risk tradeoff analysis with respect to an advance materials buy <u>prior</u> <u>to</u> the exercise of the production option of a contract.

<u>"The Airborne ICBM" Case</u>

This case addresses issues within the areas of procurement planning, solicitation, source selection, and negotiations; i.e. coping with uncertainty, estimating cost, evaluating a contractor's proposal, and negotiating final contract cost.

<u>"The Waif" Case</u>

This case is offered to illustrate a procurement planning and negotiating effort. The intent is to "put together" some of the factors affecting procurement planning and the acquisition strategy as addressed in the previous cases ("The Sting," "The Widget," "The Airborne ICBM"). The case is divided into two parts. Part A asks the student to determine a negotiating position for the Air Force. Part B presents the events, i.e. the negotiations, as they actually transpired.

II. THE STING

SUGGESTED CLASS PROCEDURE

Two suggested options for the case presentation include:

1. Distribute the case to each student for overnight analysis (recommended time for analysis: 45-60 minutes) and subsequent in-class discussion (recommended time for discussion: 30 minutes); or,

2. Assign the case to a 3 or 4 man team for analysis and presentation to the class (team preparation time: 2 hours; team presentation time: 30-45 minutes, including response to class questions).

THE STING[1]

The Air Force wants to contract for a second buy of the Sting air-to-surface missile. Aerospec Corporation is currently responsible for the initial production run of 1,400 missiles; the first missile has yet to be delivered.

Lieutenant Colonel Stand, procuring contracting officer for the Sting, has Aerospec's contract proposal for the second buy before him and is pondering the establishment of a favorable contract negotiating position for this sole-source procurement. The second buy will provide for the acquisition of 435 Sting missiles over a three-year period, as well as related ground support equipment, training services, and technical data. Missile deliveries will begin ten months from the date the contract is signed. The contractor submitted his basic proposal (fixed-price-incentive-fee) on 1 April and quickly followed with 12 separate revisions. Attachment 1 presents a recap of these proposals and related costs.

---

[1]This case is based on a paper prepared by Lieutenant Colonel William E. Schaefer in partial fulfillment of the requirements for a Master of Science degree in Logistics Management at the Air Force Institute of Technology. The authors are responsible for the theoretical development, the conversion of the material into the case format, and the classroom support suggestions.

The aerospace industry has been particularly hard hit by the economic recession of the early 1970's, and consequently has experienced a significant loss of business over the past three years, resulting in a reduction of personnel from 150,000 to 50,000 employees. It would seem intuitive that the second buy proposal would reflect a conservative estimate of what the Sting should cost under efficient operating conditions, given Aerospec management's well-known desire to compete for aerospace business. Colonel Stand observes, however, that the initial negotiated unit price of the first production buy is approximately 20 percent lower than the contractor's second buy per unit cost estimate. While this 20 percent per unit cost differential might in part be attributed to economic inflation and increased overhead resulting from a reduced production base within the company, Colonel Stand is dubious. Also contributing to his uncertainty are two Air Force independent cost estimates (ICE) of a $270 million total program cost (both Mr. Don Stallard of Advanced Weapons Development and Mr. John Dollaro of the Comptroller's shop used parametric cost techniques and economic indices to independently arrive at the $270 million estimate).

Colonel Stand realizes that in view of the contractor's 60 percent work force reduction over the past three years the company's historical overhead costs are minimally useful for cost projections. He has also learned that the Aerospec management has proposed a new overhead cost control

plan (the Vice President of Finance for Aerospec has stated that they are planning for large efficiencies, possibly as much as 25 percent in the overhead area) to be implemented during the second year of the three year second buy contract.

Colonel Stand is also concerned with the proposed subcontract procurements of the G-11 guidance system for the Sting. From his experience, he is aware that the G-10 guidance system, which is quite similar to the G-11, has been previously produced by the proposed subcontractor, Directa, Inc. One thousand four hundred (1,400) of the G-10 have been completed and the last 100 are currently on the production line. The proposed subcontract is for the acquisition of 435 units of the G-11. Colonel Stand knows that the technology and manufacturing processes used in the G-10 are essentially the same as for the G-11; however, the Directa proposal projects from a 90 percent learning curve for the 435 units to be produced on the proposed contract. Since there is an estimated 99 percent commonality in manufacturing techniques and processes for the G-10 and G-11, Colonel Stand believes that the Government may not be receiving the benefit of the subcontractor's learning in this area, particularly since a firm-fixed-price contract is contemplated. A brief excerpt from the Directa, Inc. proposal for 435 units of the G-11 follows:

Labor	Hours	Rate	Amount	Total
Manufacturing Labor	900,000	$5.	$4,500,000	
Engineering Labor	100,000	$8.	800,000	$5,300,000
Overhead				
Manufacturing Overhead		100%	$4,500,000	
Engineering Overhead		150%	1,200,000	$5,700,000
Material				4,000,000
Subtotal				$15,000,000
Profit @ 10%				1,500,000
TOTAL				$16,500,000

From discussions with prime contractor personnel and a Government auditor, Colonel Stand has learned that the subcontractor, Directa, Inc., has averaged 1,460 manufacturing hours for each of the last lot of 50 model G-10's which they produced and that they have been performing on an 80 percent improvement curve.

Finally, Colonel Stand questions Aerospec's proposed fixed-price-incentive-fee contract. In particular, 10 percent of the target cost (approximately $34 million) is earmarked for an engineering effort. He feels this may be high since this will be the second production run of the missile.

Colonel Stand has asked you to help him arrive at a favorable contract negotiating position.

List of Abbreviations

ICE--independent cost estimate

FFP--firm-fixed-price

FPIF--fixed-price-incentive-fee

PCO--procuring contracting officer

Glossary

Firm-fixed-price: This contract type is an agreement by the contractor to furnish specified supplies or services at a stipulated price which is not subject to adjustment because of performance costs; it implies a great amount of risk to the contractor and provides the maximum potential for profit to the contractor.

Fixed-price-incentive-fee: This contract type places a ceiling on the total price for performance of the contract and includes a provision for the adjustment of profit and establishment of the final price (not to exceed the ceiling) by a formula based upon the relationship final costs bear to the target costs of the initial negotiation. If final costs are less than target costs, the formula provides greater than the target profit. If final costs exceed target costs, the formula provides less than the target profit.

Independent cost estimate: The review and evaluation of a contractor's cost or pricing proposal and of the judgmental factors applied in projecting from the data to the estimated costs, in order to form an opinion on the degree to which the contractor's proposed cost represents what performance of the contract should cost, assuming reasonable economy and efficiency.

Learning curve: A tool of calculation used primarily to project resource requirements in terms of direct manufacturing labor hours or the quantity of material required for a production run. Used interchangeably with "improvement curve." Learning or improvement curve theories include:

- -- The Boeing or unit curve theory: as the total quantity of units produced doubles, the cost per unit decreases by some constant percentage (the rate of learning).
- -- The Northrup or cumulative average theory: as the total quantity of units doubles, the average cost per unit decreases by some constant percentage (the rate of learning).

Procuring contracting officer: The focal point at the activity contracting for goods/services. He initiates solicitations, receives proposals, conducts negotiations, and awards contracts.

Summary

Contractor's Proposed Price
(Amounts in 000,000's)

Proposal Action	Date	Target Cost	Target Profit	Target Price	Remarks
(NOTE 1)					
Basic	1 Apr	$340	$42	$382	
Update #1	15 May	337	42	379	Correction
Update #2	1 June	333	42	375	Correction
Update #3	20 June	332	41	373	(Materials) (Update)
Update #4	20 June	$329	$41	$370	(Mfg. Reduc.)
Delta 1-6	15 Jn-14 Aug	.9	.1	1	
Delta 7	20 July	10	1	11	
Delta 8	15 July	3	.5	3.5	
NET PROPOSAL		$341.1	$42.4	$383.5	

NOTE 1: The contractor, Aerospec, submitted his initial proposal on 1 April. Following that submission, Aerospec submitted four updates which constituted effectively four new proposals. In addition to those revisions, eight delta modifications to the final update were submitted. These delta modifications represented the value of a given change as it related to the last update and not a complete re-summarization of the proposal.

INSTRUCTOR GUIDANCE

A number of questions are generated by the case:

1. What is the significance of the differential between the contractor's project target cost of $341 million and the independent cost estimates of $270 million?

<u>Answer</u>. The case does not present sufficient information to specify where differences exist between contractor and independent estimates. This in itself is significant, i.e. at this point in time Colonel Stand cannot rationally rely on either the $341 million or the $270 million estimate; neither does he have the information to allow him to arrive at a figure between estimates. This lack of information might well partially justify a limited Should Cost effort.

2. Is it feasible for Aerospec to implement its proposed new overhead cost control plan concurrently with the first year of the second buy contract, thereby reducing cost estimates for the project?

<u>Answer</u>. Again, case information is lacking. This lack of information is characteristic of the situation early in the acquisition/procurement cycle, i.e. uncertainty is high. The manager must try to reduce uncertainty. A Should Cost evaluation might produce the information which would support the feasibility of the cost control plan

implementation. Should Cost might even result in making the contract contingent on plan implementation.

3. With respect to Directa, Inc., can a case for applying an 80 percent learning curve be developed and would the application of an 80 percent cost curve result in significant savings for the government?

Answer. Knowing that the G-10 and G-11 had 99 percent commonality, rational support for considerable carryover of learning from the G-10 to the G-11 could be generated. Analysis indicates that the disposition of the 1,400 G-10's is as follows:

1,300	Completed
100	In Production
1,400	TOTAL

These G-10 units had been worked on an 80 percent improvement curve, with the last lot of 50 averaging 1,460 manufacturing hours. This was considered to be significantly lower than the estimated average of 2,069 manufacturing hours projected by the contractor for the G-11 (900,000 hours 435 units = 2,069 hours/unit).

To develop a more realistic estimate for the current procurement for the 435 G-11's, the following was computed:

Hours for Last Lot of 50 Model G-10.	1,460	
Add: Estimated Factor to Cover Commonality Difference and Start-Up (10% factor x 1,460).	140	(rounded)
Initial Estimated Hours for First G-11 Unit.	1,600	

This 1,600 hours serves as the baseline from which to produce a revised estimate using an 80 percent improvement curve. Apply the Unit Improvement Curve Theory as follows:

(1) Unit	(2) Manhours	(3) Cum. No. of Units	(4) Conv. Factor	(5) Cumulative Average Manhours Col (2) ÷ Col (4)	(6) Cumulative Total Manhours Col (3) × Col (5)
1	1,600	1	.678	2,360	2,360
2	1,280	2	.678	1,888	3,776
4	1,024	4	.678	1,510	6,041
8	819	8	.678	1,208	9,664
16	655	16	.678	966	15,457
32	524	32	.678	773	24,732
64	419	64	.678	618	39,552
128	336	128	.678	496	63,434
256	268	256	.678	395	101,191
435	225	435	.678	332	144,358
		TOTAL			410,565

Based upon the above information, the total estimated manhours to produce the 435 G-11 units on an 80 percent learning curve would be 410,565 manhours rather than the 900,000 manufacturing hours proposed by the contractor. Therefore, it might be recommended that the initial Government negotiation position be established on that basis.

4. Given Aerospec's estimate for $34 million for engineering effort and the fact that this will be the second production run of the missile, is a fixed-price-incentive-fee contract appropriate?

<u>Answer</u>. Perhaps a better alternative would be a cost-plus-incentive-fee contract. The engineering effort

might be isolated under this contract and greater government surveillance applied to it.

A mini-team (6-8 members) Should Cost effort might well be appropriate for providing the information necessary to resolve Colonel Stand's dilemma. Air Force Pamphlet 70-5, 3 Feb 73, discusses the Should Cost concept and addresses various team constructs, advantages and disadvantages of the full team, mini-team, flexible team, and advance team approaches to a Should Cost effort.

The following definition of Should Cost and criteria for application (AFP 70-5) are presented as a general introduction to the concept:

> Should Cost. A technique of contract pricing that employs an integrated team of Government procurement, contract administration, audit, and engineering representatives to conduct a coordinated, in-depth cost analysis at the contractor's/subcontractor's plants. The objective is to identify uneconomical or inefficient practices in the contractor's management and operations and to quantify the findings in terms of their impact on cost. The result is the development of a realistic price objective which reflects reasonably achievable economies and efficiencies.
>
> . . . It has been found, ideally, that Should Cost reviews are most productive when employed on procurements for which there are future year production requirements for substantial quantities of like items; there has already been some production--in all probability the initial production run; a sole source situation; the specification is comparatively definitive and not likely to be changed; and the present and potential value of the work is substantial.

<u>Suggested Readings</u>

1) Air Force Pamphlet 70-5, 3 Feb 73.

2) Belden, David L., and Earnest G. Cammack. <u>Procurement</u>. Washington, D.C.: Industrial College of the Armed Forces, 1973, Chapters 6 and 7.

III. THE WIDGET

SUGGESTED CLASS PROCEDURE

Distribute the case to each student for overnight analysis (recommended time for analysis: 45-60 minutes) and subsequent instructor-led discussion (recommended time for discussion: 30 minutes).

THE WIDGET[1]

The F-22 is to be the Air Force air superiority fighter of the 1980's. The Tactical Electronic Warfare System (TEWS) is the heart of the F-22's electronic defense and is essential to the fighter's survivability in a hostile environment. Within the TEWS, the detection and identification of enemy threat is dependent upon a black box known as the Weapon Interrogation and Detection Gadget for Electromagnetic Transmissions (Widget).

In 1974, Shock Electronic Systems, Inc. was awarded a research and development contract for the development of the Widget subsystem of the TEWS. Basic negotiations for 95 Widgets (Lot I) were completed in early December, 1975. Included in that negotiation was an option to procure an additional 72 Widgets (Lot II). The contract was awarded in February, 1976, and stipulated Lot I to be delivered not later than April, 1978; the option on Lot II could be exercised as late as December, 1976. The basic fixed-price-incentive-fee (FPIF) contract reflects the following:

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[1]This case is based on a paper prepared by Captain Greg A. Mann in partial fulfillment of the requirements for a Master of Science degree in Logistics Management at the Air Force Institute of Technology. The authors are responsible for the theoretical development, the conversion of the material into the case format, and the classroom support suggestions.

Lot I - 95 Widgets

Target Cost	$29,350,000
Target Profit	2,800,000
Target Price	$32,150,000
Ceiling Price	$36,105,000

Lot II - 72 Widgets

Target Cost	$15,160,000
Target Profit	1,440,000
Target Price	$16,600,000
Ceiling Price	$18,700,000

Subsequent to the basic contract negotiations in December, 1975, a memorandum was issued from the Secretary of Defense to the Secretary of the Air Force concerning the F-22 TEWS program. The memorandum directed the Air Force to investigate means to effect savings in TEWS procurement costs, including the Widget acquisition.

One possibility for effecting savings in the Widget acquisition is to combine the procurement of materials for the Lot I and the Lot II options. The decision to combine the material procurements belongs to the F-22 System Program Office (SPO). If the SPO decides against the combined procurement, the possibility for a savings to the Air Force would be foregone. A decision in favor of the combined procurement could result in a considerable loss to the Air Force as a consequence of changes from value engineering studies. In other words, advancing state-of-the-art in electronic warfare gadgets might render the Lot II Widgets obsolete prior to their installation in the F-22.

The F-22 SPO engineers indicate that the materials required for Lots I and II are relatively stable and are unlikely to change as a result of value engineering changes. Two items are identified, however, as possible candidates for change. These are the cathode ray tube assembly (which could change from a 4 inch to a 3 inch tube) and the high voltage power supply (which could change to a smaller, more efficient unit as a result of increased competition within the electronics industry).

Shock Electronics has submitted a contract change proposal that identifies the following savings if a combined procurement of Lot I and II materials is made:

<u>Savings Resulting from Shock Proposal</u>

Target Cost	$2,443,833	
Target Profit	119,192	
Target Price	$2,563,025	= Total Savings

Shock did not propose an adjustment of ceiling prices; a termination liability of $8,600,607 was requested in the event that the Lot II option is not exercised.

Mr. Pretty Quick, the Manager for Contract Administration for Shock Electronics, has submitted the following data to the F-22 procurement office in support of Shock's contract change proposal which would save the Air Force approximately $2.5 million by combining the procurement of materials for Lots I and II.

Cost Element	Estimated Savings
Total Material	$1,428,690
Material Overhead	192,873
Special Test Equipment	30,000
600IQ Computer	330,883
TOTAL MFG. COST	$1,982,446
G & A	461,387
Target Cost	$2,443,833
Target Profit	119,192
Target Price	$2,563,025

Mr. Quick indicates that the total material savings of $1,428,690 was developed by summing the material costs negotiated for both Lot I and Lot II. This amount is $12,448,239. By combining the procurement of materials for both Lots I and II, he claims that total material cost can be reduced to $11,019,549. The $11,019,549 cost was developed as a result of a requote from Shock's major vendors.

The basic Lot I material cost is $53,147 per unit, excluding standard expenses of freight-in, shrinkage, and refurbishment cost. Mr. Quick received a requote on $25,206 of the per unit material cost from his major vendors; this requote price was $24,257. Without going to each of the smaller vendors, he estimated a 4.5 percent requote reduction on the remaining $27,257 per unit material cost; this estimated requote price was $26,707. Summing the requotes, the Lot I per unit material cost for a combined Lot I and Lot II material buy is $50,964. After adding the cost of freight-in, shrinkage and refurbishment and

multiplying by 95 units, the total Lot I cost for a combined material buy is $6,627,160.

The total bill of material for Lot II was $5,504,225 which included 15 percent escalation. Combining the Lot I and Lot II material buys results in a total Lot II cost of $4,392,389. Adding the new bill of material for Lot I ($6,627,160) and Lot II ($4,392,389) results in a total of $11,019,549:

Original Negotiated Material Cost for Lots I and II	Combined Buy Material Cost For Lots I and II	Projected Savings
$12,448,239	$11,019,549	$1,428,690

The 600IQ Computer cost is the second major area of cost reduction resulting from the combining of the Lots I and II material buy. Mr. Quick estimates the Government could save approximately $330,883 in this area ($4,620,191 negotiated computer cost less $4,289,308 estimated computer cost as a result of the combined buy). Mr. Quick also estimates an additional cost of $30,000 will be needed to perform retesting of the various vendor supplied material and subcomponents. He indicates this retesting cost basically involves generating computer programs for the computer controlled testing devices to check integrated circuits, semiconductors and other components.

In the event the Lot II option is not exercised, Shock estimates $8,600,607 to be the maximum Government termination liability. This amount is considered reasonable

by Captain Smith, the F-22's procuring contracting officer, as it is representative of the probable cost of purchasing the Lot II materials. The following is a breakout of the Government maximum termination liability as estimated by Shock:

Material	$4,392,389
Material Handling	550,197
Other Direct Costs	1,475,132
Subtotal	$6,417,718
G & A	1,464,207
Subtotal	$7,881,925
Profit	718,682
Termination Liability	$8,600,607

The Material cost represents the reduced cost of the Lot II material based on a combined buy of both Lot I and Lot II materials. Other Direct Cost represents the reduced cost of Lot II computers based on combined purchases of both Lot I and Lot II computers. The Material Handling and G & A rates are also considered reasonable by Captain Smith.

Included in the Shock proposal is an adjustment to the items of Lot I affecting non-recurring cost. Before evaluating this aspect of the new proposal, Captain Smith decided he needs to conduct a review of the non-recurring cost arrangements contained in the original contract for Lot I. He finds:

A. Shock Electronics has a poor history of delivery on the research and development contract under which the Widget was developed. Numerous delays and extensions were required in developing the Widget to the prescribed Air Force specifications. Currently the prototype testing has

revealed deficiencies which must be debugged. The Widget is oversensitive and somewhat paranoid in transforming stray voltages into a display of enemy threat.

B. Included in the target price of $32,150,000 for the first lot of Widgets is a non-recurring cost of $5,361,113. In addition to the incentive contained in the 80/20 sharing arrangement (fixed-price-incentive-fee contract) negotiated for Lot I, an opportunity existed for further incentivization of deliveries. The amortization of 80 percent of the non-recurring costs over the delivery of the first 57 Widgets was negotiated. This meant Shock could not recover 80 percent of the non-recurring costs without delivering acceptable hardware. A good performance incentive! The remaining 20 percent of non-recurring costs were amortized over the delivery of the R/F transmission lines. Under present contractual arrangement, Shock may recover 20 percent of their non-recurring cost ($1,022,223) by September, 1976, and 80 percent by December, 1977.

Mr. Quick has proposed a reversal of the original arrangements outlined above which would amortize $4,289,890 (80 percent) over the delivery of the R/F cables (September, 1976); and the remainder would be amortized over the delivery of 57 Widgets (December, 1977). This, in effect, would nullify the "delivery" incentive negotiated on the original purchase.

Captain Smith must evaluate this proposal for a rearranged amortization and formulate a recommendation to

the F-22's Chief of Procurement, Colonel Bull. He must also develop a recommendation concerning the combined procurement of Lot I and Lot II material. What should he recommend?

List of Abbreviations

FPIF--fixed-price-incentive-fee

G & A--general and administrative

SPO--System Program Office

TEWS--tactical electronic warfare system

WIDGET--weapon interrogation and detection gadget for electromagnetic transmissions

Glossary

Fixed-price-incentive-fee: This contract type is an agreement by the contractor to furnish specified supplies or services at a stipulated price which is not subject to adjustment because of performance costs; it implies a great amount of risk to the contractor and provides the maximum potential for profit to the contractor.

General and administrative: Indirect expenses, including a company's general and executive offices, executive compensation, the cost of staff services such as legal, accounting, public relations, financial and similar expenses, and other miscellaneous expenses related to the overall business.

Value engineering: Is a concept of cost reduction of supplies and services procured by the Government in its contracts; value engineering clauses within contracts encourage the contractor to develop and submit cost reduction proposals which involve changes in contract specifications, purchase description, or statement of work.

INSTRUCTOR GUIDANCE

DOD direction is to save Government procurement dol- s. The risk/uncertainties involved in deciding whether or not to combine the procurement of materials for Lots I and II must be coped with. Some factors against a combined material buy are:

A. The F-22 SPO may elect not to execute the Lot II option because:

(1) Rapidly advancing state-of-the-art electronic warfare technology may render the Widget obsolete.

(2) Shock Electronics has not yet successfully debugged the Widget and has not proven it can, in fact, meet the Lot I production schedule.

B. Should the SPO not exercise the Lot II option, it would be left with $8.6 million worth of Widget parts/ materials.

C. The effort by Shock to dilute the effectiveness of the incentives negotiated in the basic contract (amortization of non-recurring cost issue) raises doubt as to Shock's confidence in its own ability to deliver acceptable Widgets on schedule.

Some factors favoring the combined buy are:

A. The SPO has the opportunity to realize a potential savings in excess of $2.5 million.

B. Shock is willing to accept additional risk with respect to its potential profit.

C. SPO engineering studies indicate a minimum probability of technological obsolescence.

The case illustrates one small aspect of a weapon system acquisition. Decisions must be made in the absence of complete information, i.e. in the presence of risk and uncertainty. Often the decision process is time constrained, e.g. in this case a decision with respect to the combined procurement of materials was, in fact, time constrained--the basic contract had already been negotiated and the not later than date for exercising the Lot II option was only ten months away. If a decision is not made in a timely manner, the opportunity for cost savings will have passed. Somehow, the manager must balance the knowns and unknowns and arrive at a decision.

Within the context of this case, the decision was made to combine the procurement of materials for both Lots I and II (there was no change to the Government termination liability of $8,600,607). The Lot II production option was originally scheduled to be exercised not later than December, 1975, but was delayed until March, 1976. The SPO did, in fact, elect to exercise the option.

The SPO did not yield to Shock's proposed change to the amortization of non-recurring costs, i.e. it was felt that the delivery incentive as negotiated in the original contract was necessary to protect Government interests.

Negotiations for the combined materials procurement were, in fact, broken off by Shock after an impasse developed over the issue of amortization. However, after a matter of days, negotiations were resumed and while Shock accepted the originally negotiated amortization, the SPO recognized the additional risk to Shock with the combined materials buy and Shock's profit objective was minimally increased (9.5 percent to 11.1 percent profit rate).

IV. THE AIRBORNE ICBM

SUGGESTED CLASS PROCEDURE

The following case analysis/presentation techniques are suggested:

1. Divide the class into teams of four or five members.

2. Assign each team the task of analyzing the case and developing alternative actions and a recommended "solution." Estimated student preparation time: 1 hour.

3. Four alternatives for the case presentation are offered:

a. Have each team brief alternatives/recommended "solution" to the class. Estimated class time: 15 minutes per team.

b. Have a representative from each team brief alternatives/recommended "solution" to the class. Estimated class time: 15 minutes per briefing.

c. Assemble representatives from each team into a panel to discuss alternatives/recommended "solution" in front of the class. Questions would be invited from the class (and the instructor). Estimated class time: 30-40 minutes.

d. Have representatives from each team represent their team's solution to negotiate a "class solution."

Estimated class time: 30-45 minutes. Class discussion of alternatives after negotiations. Estimated class time: 15-30 minutes.

THE AIRBORNE ICBM[1]

It was Sunday, 6 August, and the scene was the Pentagon. Officials of the Payoff Corporation and representatives of the Air Force Missile System Program Office (AFMS) and the Big Bird System Program Office (SPO) were called to Washington by the Chief of Staff. The Chief stated that a requirement existed for a demonstration of the feasibility of extracting a Big Bang ICBM from a Big Bird aircraft and igniting the missile for a short duration burn. The successfully demonstrated capability would be studied as a deployment option for the missile. The Chief directed that the requirement be put on contract within two weeks and that the feasibility demonstration be conducted within 75 days. He advised that sufficient funding for the contract would be made available to AFMS within the next few days. After the meeting, the officials and representatives hastened back to their respective organizations to satisfy the Chief's desires.

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[1]This case is based on a paper prepared by Lieutenant Louis R. Albani in partial fulfillment of the requirements for a Master of Science degree in Logistics Management at the Air Force Institute of Technology. The authors are responsible for the theoretical development, the conversion of the material into the case format, and the classroom support suggestions.

The next day, back at the Big Bird SPO, Captain Terry Fly, a buyer in the Big Bird Procurement Division, and his boss, Dan D. Lion, a procuring contracting officer, were called into the Procurement Division Chief's office. They were briefed on the events of the preceding day and were told to get the Chief of Staff's requirement on contract. Dan D. Lion turned to Captain Fly and suggested that now would be a good time for Terry to get his "feet wet" with a challenging procurement. The Division Chief agreed and further suggested that Terry be given as much latitude as necessary to prepare for and negotiate the procurement.

Terry decided that he should take the time and ponder the points to be considered in this procurement. He realized the importance of time and he knew that proper planning of his actions was necessary in order to meet the imposed deadlines. He also knew that there were certain actions that had to be accomplished in the procurement process. He reflected on some of the pertinent aspects of the proposed procurement:

--A sole-source of supply was "dictated." Only the Payoff Corporation, which designed, developed, analyzed, and tested the Big Bird aircraft, had the expertise necessary to modify Big Bird and to carry out the testing required to expeditiously demonstrate the desired capability within the time constraints established. It had also been decided at the meeting between the Chief of

Staff, Payoff Corporation, and the SPO officials that a Payoff flight crew would fly the Big Bird aircraft during the test.

--A letter contract seemed appropriate to use in order to get the contractor to begin work with minimum delay. Terry knew this contracting instrument was frowned upon by DOD because of its many caveats and provisions. He felt, however, that he had no choice in this particular situation. As the contract duration was only 75 days, he knew he could not drag his feet definitizing the letter contract. He also knew that in order to protect the Government's interests, the letter contract had to include agreements:

(1) that the contractor will commence work without delay;

(2) on the anticipated type of definitive contract to be entered into at a later date;

(3) that the contractor will not incur obligations in excess of the limit set in the letter contract;

(4) on certain definitive contract clauses; and,

(5) that the contractor will enter into negotiations promptly and in good faith to arrive at a definitive contract with the Government.

-- Terry felt that a cost-plus-fixed-fee (CPFF) contract should be definitized because the level of

effort was not known with certainty as a result of the time constraints of the effort.

--The AFMS indicated that $2,885,000 was available for this procurement; Terry decided to use this amount as the not-to-exceed (NTE) limit in the letter contract.

--Terry could not think of any special contract clauses to be included in the letter contract.

--Terry knew of the Armed Services Procurement Regulation (ASPR) requirement that procurements over $100,000 had to be subjected to a formal price analysis by the Pricing Division. He also knew that the turn around time for the analysis report was 30 to 45 days, so he contemplated requesting a waiver of this requirement. An Air Force Plant Representative Office (AFPRO) was located at Payoff and Terry felt that they could provide some of the pricing and proposal evaluation support, if necessary.

Having carefully considered and planned for all the tasks to be accomplished, and after receiving information from AFMS, Terry issued a letter contract on 14 August with an NTE of $2,885,000. The commodity identification was engineering and associated support to provide development planning and aircraft modifications required to extract an inert Big Bang ICBM from a Big Bird by 30 September and to

extract a live Big Bang by 31 October. The period of performance would be 15 August to 31 October.

Terry also prepared a letter to be sent to the Pricing Division requesting that their review be waived in view of the circumstances. Approval was granted on 5 September. Terry, Mr. Lion, the AFPRO pricing and engineering personnel, and the resident Defense Contract Audit Agency (DCAA) representative at Payoff Corporation would perform the necessary analysis and subsequent negotiations.

The contractor's proposal arrived at the Big Bird procurement office on 10 September and Terry made arrangements to be at Payoff for fact finding sessions on 16 and 17 September; Air Force review and analysis would be concurrently performed. He hoped to begin negotiations on 18 September.

The contractor's proposed bottom line price for the contract was $2,802,314. He was not surprised to see the bottom line price so close to the NTE of the letter contract. The 12 percent fee proposal was not surprising either; the fee is always an issue on CPFF contracts. Terry noted the presence of overtime premiums in the proposal and wondered if any of this was for salaried employees. Other salient aspects of the proposal are included at Attachment 1. He jotted down his questions for the fact finding sessions. He was certain that on-site government personnel would also note questionable areas in the proposal and hoped that together they could establish a negotiable government position.

During the fact finding sessions, Terry was informed by Mr. Payer, representing the Payoff team, that they desired to amend their proposal to include an Indemnity Clause because of the high risks involved in the contract performance. Terry replied that he would take it into consideration and let Payer know.

Because of the compressed time schedule, Terry decided that fact finding should focus on the engineering estimate which comprised $1,937,032 of the total manufacturing cost of $2,295,446 (see Attachment 1). Terry knew that a reduction of this estimate would also mean a further reduction in the total price of the contract because the general and administrative (G & A) estimates and the fee proposal were computed as percentages of the total manufacturing cost.

The contractor proposed a total of 82,837 engineering hours based on departmental estimates. This consisted of 38,558 on-site hours and 44,279 off-site hours. Because the program involves a quick response time and a tremendous amount of off-site effort, the contractor needed to "draw" people from the "proration pool"[2] to have the number of

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[2]Each engineering department computes its internal Supervisory and Clerical (S & C) staff labor hours as a percentage of the direct labor hours of that department. The applicable S & C proration factor is derived by taking the ratio of S & C personnel to a base number of employees in the department. Average percentage factors have been negotiated for each of the engineering departments by the Air Force and Payoff for forward price estimating. In addition, the administrative functions performed by engineering administrative departments are prorated over the engineering departments which they service/administer. Prenegotiated factors have also been established for these

people required to complete the contract within the time constraints.

One reason for the use of engineering proration factors instead of an overhead expense approach is that it is Payoff's policy to charge engineering manhours directly to a contract whenever possible. Thus, if a supervisor's or administrative engineer's time can be directly identified as being dedicated full time to one contract, his hours are no longer prorated but are charged directly to that contract. A typical pre-negotiated proration factor is 20 percent (i.e. 20 percent x estimated direct labor engineering hours = number of overhead hours).

With respect to this proposal, Payoff complied with its policy by identifying the S & C personnel from the proration pool who would be dedicated full time to the program's off-site effort and allocated all of their time as direct engineering labor hours, off-site. For on-site support, Payoff used the pre-negotiation factors to estimate the manhours to be charged as direct engineering labor hours for the program.

Payoff proposed an overhead rate of $7.01 per hour, which was the pre-negotiated rate. However, the AFPRO pricing personnel remembered that subsequent to those negotiations

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administrative functions. The result of the use of proration factors is the estimation of supervisory, clerical, and administrative manhours as direct engineering hours through proration to the estimated departmental manhours rather than assigning these functions to a part of the overhead expense rate.

an agreement was made that wind tunnel testing would be charged directly to contracts on a usage basis rather than prorated over all contracts as an overhead charge. The amount of overhead rate assigned to wind tunnel testing was $.17 per hour.

It was discovered that overtime premiums were included in the proposal for salaried personnel. Overtime for non-salary personnel (i.e. hourly workers) was included at the normal wage scale of time and a half and double time in accordance with union agreements. Terry was concerned as to the allowability of these costs. He felt that perhaps they were justified because of the long hours required to meet the compressed time schedule. Mr. Payer told him that the salaried people were working 10-12 hour days, seven days a week. Terry contemplated a call to the Pricing Division for help.

The contractor proposed a total of $258,202 for material and direct charges. The AFPRO pricing personnel detected a computational error of $30,000 and, as a result, the correct figure proposed should have been $228,202. Further, AFPRO technical personnel recommended a deletion of $83,500 for telemetry requirements and 16 mm gun cameras which were not required for this program. A reduction of $10,000 was also recommended in the contingency area for tooling miscellaneous materials because such a requirement was not envisioned by the AFPRO evaluators.

Contract labor costs consisted of secretarial help, security guards, a truck driver, and a part time dispatcher. These personnel were hired from a local agency to help with the employee overload. Terry wondered how he could verify these proposed estimates.

The contractor proposed a fixed fee of $300,248, which represents 12 percent of proposed cost. Terry planned to use the weighted guidelines as outlined in ASPR 3-808 to arrive at the cost-based profit/fee objective.

Having completed fact finding, Terry called a meeting of the government team members to establish a negotiating position. As a member of the negotiating team, what recommendations would you make to Captain Fly? Terry has requested that you assign weights (weights represent percentage of profit on the contract) to the following factors to assist in determining the percentage profit/fee.

Factor	Weight Range	Weight You Assigned
Cost Risk	0% to 7%	
Performance	-2% to +2%	
Selected Factors	-2% to +2%	
Special Profit	0% to 8%	

You will need to provide rationale for the weights you assign. Assume that whatever weights you assign will be added to a base profit/fee percentage of 7.9 percent. Additionally, Terry is interested in constructive criticism and has asked you for your comments regarding the way he handled

the task assigned to him by Dan D. Lion and the Procurement Division Chief.

List of Abbreviations

AFMS--Air Force Missile System Program Office

AFPRO--Air Force Plant Representative Office

ASPR--Armed Services Procurement Regulation

CPFF--cost-plus-fixed-fee

DCAA--Defense Contract Audit Agency

G & A--general and administrative

ICBM--intercontinental ballistic missile

NTE--not-to-exceed

SPO--System Program Office

Glossary

General and administrative: Indirect expenses, including a company's general and executive offices, executive compensation, the cost of staff services such as legal, accounting, public relations, financial and similar expenses, and other miscellaneous expenses related to the overall business.

Weighted guidelines: A technique of negotiated procurement the Government uses to insure consideration of the relative value of appropriate profit factors in establishing a profit objective and conducting negotiations. Also used as a basis for documenting and explaining the final pricing agreement reached between buyer and seller. Appropriate profit factors include contractor's input to total performance, contractor's assumption of contract cost risk, record of contractor's performance, selected factors (such as source of resources) and any special profit consideration.

CONTRACTOR PROPOSAL

Cost Element	Rate	Amount
Engineering		82,837 hrs
Direct Labor	8.76	$ 725,652
Overhead	7.01	580,687
Overtime Premium		35,110
Reproduction Expense		15,423
Subsistence/Lodging		198,252
Air Fare		17,399
Car Rental		58,572
Computer Expense		2,100
Material & Direct Charges		258,202
Field Service Adjustment		30,959
Contract Labor		14,676
Total Engineering		$1,937,032
Quality Assurance		12,030 hrs
Total Quality Assurance		$ 272,251
Planning		124 hrs
Total Planning		$ 2,222
Customer Services		5,601 hrs
Total Customer Services		$ 83,941
Total Manufacturing Costs		$2,295,446
General & Administrative	2.27	206,620
Total Cost		$2,502,066
Fee	12.0%	300,248
TOTAL COST PLUS FIXED FEE		$2,802,314

Attachment 1

INSTRUCTOR GUIDANCE

The case is based on a procurement handled by the Procurement Division of the Deputy for Airlift/Tanker Aircraft SPO. The service contracted for with Lockheed-Georgia was entitled the "Air Mobile Feasibility Demonstration." Some of the general concepts intended to be demonstrated by the case are:

Requirements Determination

Oftentimes actions to be taken in response to a requirement are predetermined. For example, Lockheed was already the selected contractor by virtue of their being called to Washington and informed of the requirement. The primary consideration was to develop a capability in as short a time as possible. Funding was a secondary consideration.

Procurement Process

It was intended to show that the procurement process is situational. One cannot adhere to an established mode of operation but must examine the need and proceed accordingly. In this case, the use of a letter contract to get the work started, the choice of a CPFF contract, the source of supply, the waiver for a formal price analysis, the compressed

fact finding schedule, the Indemnity Clause, and the use of overtime premiums for salaried personnel were all decisions necessary to meet a stated requirement.

Cost Estimating

An important resource for use by the SPO in proposal evaluation is the AFPRO. For instance, being close to the situation, AFPRO personnel can readily detect such things as adjustments required to overhead, material requirements, and direct labor estimating (proration pool) peculiarities. The multiplicative effect that direct labor hours have in costing/pricing a contract is introduced in the case.

The case focused on the area of evaluating the proration pool estimate. The case example is of a pre-negotiated rate that does not apply to a particular contract. It is important to know the ingredients of a proration factor so that adjustments can be made if the situation dictates. One cannot blindly apply a ratio just because it has been pre-negotiated; it must be evaluated.

Contractors do make computational errors in their estimating and the inclusion of the error in the material estimate was intended to make the reader aware that all figures must be checked. Also, in the material area, the point is that contractors sometime apply historical costs without taking a detailed look at the composition of those costs.

Contract labor was a moot point within the context of this case but was included to show that examination of Purchase Orders is another method of verifying cost estimates.

The concept of weighted guidelines was introduced to illustrate that even though certain factors, such as cost risk and performance, should normally be weighted zero, the analyst must take the procurement situation into consideration. "Selected factors" was included to familiarize the reader with this aspect of weighted guidelines (ASPR 3-808.5(e)).

Credibility

Just as the procurement officer must be flexible and willing to adjust to various procurement situations, it was necessary for the authors to manipulate some of the true facts of this case. This was done in an attempt to make the case interesting and challenging to the reader.

Note

The Air Mobile Feasibility Demonstration was declared a success and the members participating in the procurement were awarded the AF Organizational Excellence Award by the Commander of SAMSO.

A continuation of the case follows which closely approximates reality, as it unfolded in the actual procurement. The following is a summary of the actual resulting contract negotiation experienced by the Air Force.

Negotiations commenced on 18 September as scheduled. The Payoff team consisted of a representative from Contracts, Finance, Engineering and Program Management. The Air Force was represented by Dan D. Lion, Captain Fly, and AFPRO pricing personnel. The negotiations proceeded without impasse as the Air Force team challenged several estimates and felt that they were successful in negotiating a fair and reasonable price for the effort involved.

The price negotiated by the Air Force was $2,525,000 which amounted to approximately a 10 percent reduction of the contractor's proposal. The summary of the negotiation outcome follows:

	Contractor Proposal	AF Objective	Negotiated
Cost	$2,502,066	$2,278,503	$2,300,000
Fee	300,248	218,736	225,000
Total CPFF	$2,802,314	$2,497,239	$2,535,000

Attachment 2 contains a breakout of the various elements of the proposal that were considered negotiated by the Air Force team. Only the elements broken out in Attachment 1 are shown for comparison purposes.

Details of Negotiations

The details of the negotiation that address the questions posed at the end of the case follow.

Contract clause. Because of the unusually hazardous risks involved in the performance of the contract, an indemnity

clause was approved for inclusion in the contract at no change in price.

<u>Direct labor</u>. The contractor's estimate was inflated because he was, in effect, charging twice for a portion of the proration pool personnel. Remember that the proration factor is derived by taking the ratio of S & C personnel to a base number of employees serviced in the department. These factors are then negotiated by the AFPRO for application when necessary. The contractor estimated the off-site supervisory and administrative manhours by identifying certain proration pool members as dedicated full-time to the program. He then estimated the on-site manhours by applying the pre-negotiated rate of 20 percent. What the contractor did not realize (or maybe he did), was that by assigning so many people out of the proration pool, he materially affected the pool manpower level and thus, the pre-negotiated proration pricing factors. The proration factor applied (20 percent) should have been reduced to account for the reduced level of proration pool manpower.

<u>Overhead</u>. The contractor acknowledged that the overhead rate included the seventeen cents for wind tunnel testing and probably should not have been included in the proposal. A rate of $6.84 was negotiated.

<u>Overtime premium</u>. Because the nature of the effort involved multiple shifts including weekends over the life of the contract, overtime is a necessary consideration to this contract.

As for salaried personnel, who would normally not receive any overtime, it was considered unreasonable for them not to receive some remuneration for working every weekend as well as working ten to twelve hour days in some cases. The Air Force negotiating team accepted the contractor's method of estimating the overtime, and, therefore, allowed the costs as proposed.

Material and direct charges. The contractor readily accepted the computational error. In fact, the figure was adjusted during fact finding. The Air Force team presented their arguments for the remaining reductions without much objection from the Payoff team. Of the $258,202 proposed, a total of $134,702 was negotiated.

Contract labor. Obviously, the verification of the estimate for contract labor could be and was easily achieved by examining the Purchase Orders issued for the services.

Fee. The total fee objective developed by weighted guidelines was 9.7 percent. A 7.9 percent composite profit/fee on cost input to total performance was developed and the following weights were added to arrive at the 9.7 percent. The final fee negotiated ($225,000) was approximately 9.8 percent of the negotiated cost.

1. Cost Risk. Because this effort is a CPFF type contract, a normal weighting would be zero. However, in recognition of the nature of the program with the time

constraints and schedules, it was felt that a certain degree of risk was involved. As a result, a .3 percentage was applied.

2. Performance. In the area of performance, the contractor is usually weighted zero, but because of his response to the schedule of the contract in such an expeditious manner with excellent quality performance to date on this effort, a +.5 weighting was assigned.

3. Selected Factors. Because of the "extraordinarily fast delivery schedule" required in the performance of this effort, as defined in ASPR 3-808.5(e), as well as the incorporation of the Indemnity Clause in the contract for unusually hazardous risks, it was the opinion of the Air Force negotiation team that the contractor qualified for a selected factor of +1.0.

4. Special Profit. In the area of special profit, no weighting was awarded for this category.

Retrospection

Considering the procurement situation, Terry felt the negotiations were successful. He reflected back to the day he was assigned this task and mentally reviewed the decisions he had made. He thought that perhaps he should have had the foresight to include the Indemnity Clause in the letter contract; otherwise, he was satisfied with the actions he had taken. That omission really did not affect the timely definitization of the letter contract or the subsequent negotiations.

Suggested Readings

ASPR 3-808

CONSIDERED NEGOTIATED

Cost Element	Rate	Amount
Engineering		70,800 hrs
Direct Labor	8.76	$ 699,048
Overhead	6.84	545,832
Overtime Premium		35,110
Reproduction Expense		3,091
Subsistence/Lodging		198,252
Air Fare		17,399
Car Rental		58,572
Computer Expense		6,300
Material & Direct Charges		134,702
Field Service Adjustment		30,959
Contract Labor		14,676
Total Engineering		$1,743,941
Quality Assurance		12,030 hrs
Total Quality Assurance		$ 271,632
Planning		124 hrs
Total Planning		$ 2,213
Customer Services		5,601 hrs
Total Customer Services		$ 82,485
Total Manufacturing Costs		$2,100,274
General & Administrative	2.27	199,726
Total Cost		$2,300,000
Fee	9.8%	22,500
TOTAL COST PLUS FIXED FEE		$2,525,000

Attachment 2

V. THE WAIF

SUGGESTED CLASS PROCEDURE

"The Waif" is presented in two parts. Part A exposes the student to events and factors to be evaluated in order to arrive at a negotiating position; Part B summarizes the negotiations as they actually transpired. The authors suggest the case be used to illustrate an actual procurement planning effort through contract negotiations. The following case analysis/presentation technique is suggested:

1. Distribute the case (Part A and Part B) to each class member for overnight reading and study. Estimated study time: 45 minutes.

2. Discuss the case in class, eliciting individual student comment/reaction (see Instructor Guidance). Estimated class time: 20-30 minutes.

<u>Suggested Reading</u>

Armed Services Procurement Regulation (ASPR), 3-808.2 <u>Weighted Guidelines Method</u>, pp. 3:140-3:142.

THE WAIF[1]--PART A

The F-6 fighter, introduced by Southrup Corporation in the 1960's has been a popular seller for years. The majority of the F-6 aircraft have been sold to allied nations and have been through the Air Force Foreign Military Sales program. A considerable number of the aircraft have also been distributed to allied nations through the Air Force Special Assistance Program.

A critical safety of flight component on the F-6 fighter is the Where-Am-I-Flying (Waif) avionics set. The Waif provides a visual display of the geographical position of the aircraft. The Waif has miniaturized, complex elements which require precision manufacturing, assembly, and testing.

Early models of the F-6 were equipped with the AQU-10/A model Waif. In 1974, the Waif manufacturer, Old Milwaukee Avionics Corporation (Old Mil), submitted an Engineering Change Proposal to improve their AQU-10/A model Waif. Seven units were modified by Old Mil. Test results

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[1]This case is based on a paper prepared by Captain Bobby G. Christian in partial fulfillment of the requirement for a Master of Science degree in Logistics Management at the Air Force Institute of Technology. The authors are responsible for the theoretical development, the conversion of the material into the case format, and the classroom support suggestions.

were so favorable that in December, 1974, the F-6 System Program Office (SPO) negotiated a contract with Old Mil for 129 of the improved model AQU-13/A Waif. Options for 152 additional units were exercised between December, 1974, and July, 1975. The AQU-13/A was to be installed on all F-6 aircraft at the Southrup plant beginning in April, 1975. Plans call for retrofit (replacement of the AQU-10/A with the AQU-13/A) operations to begin in October, 1975. Forty-eight of the new model Waifs are required by AFLC for use as spares.

Old Mil is a relatively small avionics manufacturer with fewer than 700 employees. Established in 1959, Old Mil has specialized in aircraft instrumentation with virtually all sales being made to the military. Attachment 1 lists the most recent Waif procurements through Old Mil.

Requirements for the AQU-13/A model Waifs during the calendar year 1975 totaled 318 units. Even by making maximun utilization of the options clause within the December, 1974, contract, only 281 units can be delivered during 1975. Several purchase requests have been submitted to the SPO in February and March, 1975. In May, a procurement plan was formulated and formalized. Major Ted Brown, Procuring Contracting Officer (PCO) at the SPO, and his boss, Lieutenant Colonel Paul Anderson, Chief of Procurement Group X, were especially concerned about the price and the timing of the upcoming procurement. Major Brown recalled from the last contract negotiation with Old Mil that Old Mil

negotiated very stubbornly to cover all the start-up costs associated with production of the AQU-13/A. Major Brown and Lieutenant Colonel Anderson believed that if the new contract could be executed in a timely manner, there would be no break in production at Old Mil's facility; hence, no start-up costs and an overall lower per unit cost. They intuitively felt that a $3,100 per unit cost is realistic.

No real consideration was given to using a competitive procurement. Major Brown researched the possibility and determined that it would take 22 months for another source to develop, test, and produce an equivalent Waif. A delay of this length would totally preempt the retrofit program and would eventually bring production of the F-6 fighter to a dead stop at the Southrup plant.

The procurement group decided to negotiate a firm-fixed price contract with Old Mil. An options clause was considered important because requirements for the F-6 are subject to fairly wide variation over time. The contract envisioned would call for 158 units with a 100 percent option exercisable within 210 days. The procurement plan was approved on 27 May 1975. Attachment 2 lists the significant milestones as published in the procurement plan.

On 28 May 1975 the contemplated procurement was synopsized in the Commerce Business Daily. One week later, on 4 June, the formal request for proposal was submitted to Old Mil.

Old Mil submitted their contract Pricing Proposal to the SPO on 18 June. For the basic contract for 158 Waifs, Old Mil proposed a unit price of $3,942. Units to be procured with the option were priced at $4,206. A sample testing charge of $20,886, a one-time charge for the contract, was not included in the proposed unit price. The SPO procurement group was surprised that Old Mil's proposed price was greater than the December, 1974 price. After all, Old Mil negotiated to recover <u>all</u> set-up costs associated with production of the AQU-13/A in the 1974 contract. Why were prices higher instead of lower, as expected?

Lieutenant Colonel Anderson telephoned Mr. Sly Fox, General Manager at Old Mil, concerning the proposed prices. Lieutenant Colonel Anderson very carefully discussed the break-out of costs on the 633 forms, especially the need to include engineering labor and overhead. Mr. Fox, adept at reading between the lines, agreed to resubmit new pricing proposals. On 6 August Old Mil submitted their second proposal. Comparison of the two proposals is shown in Attachment 3.

On 24 June, Major Brown requested the Defense Contract Administration Service (DCAS) to perform a pre-award survey of Old Mil. Sensing that the procurement timetable was slipping, a priority survey and audit were requested. On 1 July Mr. Slow N. Certain, Administrative Contracting Officer (ACO) at the Defense Contract Administration Services Division (DCASD) telephoned Major Brown to say that

pricing experts from DCAS would be visiting Old Mil the first week in July. Auditors from the Defense Contract Audit Agency (DCAA) were tentatively scheduled for the following week.

DCASD pricing personnel eventually made four trips to Old Mil between 26 June and 14 July. On 12 August DCASD finally requested DCAA to perform an audit. The procurement timetable was over a month behind schedule.

DCAA finished the audit on 29 August. The auditors questioned every major category of Old Mil's proposed costs. Attachment 4 lists the costs questioned by the auditors. The $203,687 of questioned costs is approximately 18 percent of Old Mil's proposed total costs.

Purchased parts costs proposed by Old Mil were based on the latest actual costs of the parts from their vendors plus a factor to cover inflation. Old Mil based their parts estimate on the Bureau of Labor Statistics (BLS) wholesale price index code 1170. Management at Old Mil subjectively increased the escalation factor to 20.5 percent per annum. DCAA auditors considered the BLS price index code 1178, which has experienced an annual increase of 4.8 percent, to be more representative of Old Mil's parts requirements for the Waif units (see Attachments 5 and 6).

Old Mil's quality assurance department estimated 1,264 hours of inspection time at $4.42 per hour for both the basic and the option quantities. When challenged, Old Mil could not defend the estimates. The auditors estimated

474 hours of inspection time but agreed to the hourly wage rate of $4.42. In a like manner, sample testing hours were reduced from 660 to 523.

Manufacturing labor costs were computed by Old Mil based on Industrial Engineering Standards times a 1.5 realization factor. The auditors could not find evidence that a realization factor of 1.5 was applicable. Auditors concluded that 60 hours of direct manufacturing labor per unit was adequate. Five of the 60 hours allowed was for a realization factor.

The second largest category of questioned costs involved plant overhead. Auditors did not question the propriety of Old Mil's computed plant overhead rate or burden of 154 percent of direct labor. However, since $36,406 of direct labor had been questioned, $56,066 of plant overhead also came under question ($36,406 x 154%).

G & A expenses of 13.1 percent were not questioned by the auditors, nor were I R & D expenses of 14.1 percent. The auditors considered $20,977 of the G & A costs questionable. This was computed by multiplying 13.1 percent times the questioned manufacturing costs of $160,131. Similarly, I R & D costs questioned derived from multiplying the 14.1 percent I R & D rate by the questioned manufacturing costs.

Lieutenant Colonel Anderson and Major Brown received the DCAS and DCAA reports approximately 1 September 1975. Over two months had elapsed since DCAS and DCAA began their

reviews. More importantly, only three months remained to negotiate a contract with Old Mil and to produce, test, and transport the first batch of Waifs. A requirement existed for 27 of the Waifs to be in place at the Southrup plant by the end of November 1975.

Both Lieutenant Colonel Anderson and Major Brown wanted to ensure a fair and reasonable price would be reached. In establishing an Air Force objective to begin negotiations, what costs should be used? Was a learning curve involved in the production of the AQU-13/A Model Waif? With inflation during the past year in the double-digit range, was the auditor's recommended escalation allowance of 4.8 percent too low to be reasonable? Was 20.5 percent too high? Imagine yourself in Major Brown's position. What would you do now?

THE WAIF--PART B

Fact-finding was conducted on 8 and 9 September at the SPO. Special emphasis was placed on establishing a fair and reasonable basis for each of the major elements of costs. Mr. Al Intrie, Price Analyst and Chief Price Negotiator for the Air Force Negotiating Team (AFNT) spearheaded the AFNT fact-finding group activities. The group heavily depended on the DCAS and auditor reports in establishing objectives for elements of costs. However, the fact-finding group determined that, on occasion, Old Mil's estimates of cost were closer to being realistic.

The fact-finding group allowed a 13.5 percent escalation factor for purchased parts. The 13.5 percent was computed by the least squares method from the BLS code 1170 index. A 5 percent discount rate was applied to the option quantity to account for the volume disccunts Old Mil would receive if an option was executed at the time of the contract award.

AFNT established an Air Force objective of 58 hours per Waif unit for manufacturing. DCAS had recommended 52.7 hours plus 5 additional hours for the realization factor. Engineering hours were set at 4 per unit for both the basic and option quantities of Waifs. AFNT rounded up to an even 4 hours of engineering labor per unit produced. This was

based on a 6 percent engineering inspection effort factor applied to standard manufacturing hours. DCAS judgment concerning sample testing hours was accepted as the Air Force objective. The auditors believed a learning curve existed but could not calculate a rate, so AFNT judgmentally applied a 92 percent learning curve to the production of Waifs.

Burdens for plant overhead, G & A, and I R & D/ B & P of 154 percent, 13.1 percent, and 14.1 percent respectively were accepted as reported by Old Mil. DCAS and DCAA did not take exception to any of these rates.

Old Mil proposed a profit rate of 15 percent of the proposed cost. AFNT developed a total profit objective of 11.1 percent of costs. The contractor's input to total performance included various weighting factors for specific activities of from 3 percent to 12 percent, for an average of 4.6 percent. An additional 6.5 percent was assigned for the contractor's assumption of contract cost risk. The primary basis of the 6.5 percent was the short delivery schedule. Attachment 5 presents the determination of profit objective in detail. AFNT relied upon the weighted guidelines instructions in ASPR to assign the objective level of contractor profits.

The Old Mil negotiating team traveled to the SPO to begin the first of a series of discussions. Mr. Jack Razzle, Old Mil's Manager for Marketing Coordination, and Mr. Bill Combs, Regional Sales Manager, met with the AFNT on 11 and

12 September 1975. Mr. Intrie, Chief Air Force Negotiator, skillfully reviewed the various elements of cost categories. Some advances were made toward reaching an agreement on 11 September but the Air Force and Old Mil teams were "miles" apart in the area of the learning curve applicability and allowable labor hours per unit (See Attachment 6).

On 12 September, the opposing teams reached an impasse. Both Mr. Razzle and Mr. Combs refused to make further reductions in Old Mil's proposal. The latest proposal by Old Mil was still too far above the Air Force objective to permit the AFNT to capitulate.

On Monday, 15 September, Lieutenant Colonel Anderson began a long, involved series of negotiations with Old Mil's Plant Manager, Mr. Fox, and with Mr. Steve Douglas, the Director of Marketing. Discussions centered primarily on the appropriate number of direct manufacturing and engineering labor hours, as these costs were used as the basis for computing most other cost elements. The negotiations progressed, as is frequently the case, with each party giving in a little at a time. Finally, on 25 September agreement was reached. The procurement plan was now exactly two months behind schedule. During the 15 day negotiation period, the Air Force had increased their offer by $27,630 plus profit percentage (See Attachment 7). Old Mil, however, reduced their proposal price (before profits) from $1,132,413 to $999,434, a sizeable $132,979 decrease.

List of Abbreviations

ACO--Administrative Contracting Officer

AFNT--Air Force Negotiating Team

BLS--Bureau of Labor Statistics

DCAA--Defense Contract Audit Agency

DCAS--Defense Contract Administration Service

DCASD--Defense Contract Administration Services Division

G & A--General and Administrative

PCO--Procuring Contracting Officer

SPO--System Program Office

Glossary

Defense Contract Audit Agency (DCAA): This agency operates under the direction of the Office of the Assistant Secretary of Defense (Comptroller) to perform contract audit services for the Department of Defense. Contract audits are primarily carried out to (1) aid in pricing, and (2) review and recommend to administrative contracting officers the action they should take on vouchers submitted for reimbursement under cost type contracts. Contract audit reports are normally required on all proposed negotiated procurements of more than $100,000.

Defense Contract Administration Services (DCAS): This agency provides field administration for all defense contracts except those specifically excluded by the Secretary of Defense.

Firm fixed price: This contract type is an agreement by the contractor to furnish specified supplies or services at a stipulated price which is not subject to adjustment because of performance costs; it implies a great amount of risk to the contractor and provides the maximum potential profit to the contractor.

Learning curve: A tool of calculation used primarily to project resource requirements in terms of direct manufacturing labor hours or the quantity of material required for a production run. Used interchangeably with "improvement curve." Learning or improvement curve theories include:

- -- The Boeing or unit curve theory: As the total quantity of units produced doubles, the cost per unit decreases by some constant percentage (the rate of learning).
- -- The Northrup or cumulative average theory: As the total quantity of units doubles, the average cost per unit decreases by some constant percentage (the rate of learning).

<u>Least squares method</u>: Is a linear regression technique that involves determining a unique straight line which has the property that the sum of the squares of the deviations of the actual vertical distances from this line is a minimum.

SYNOPSIS OF PREVIOUS WAIF PROCUREMENTS

Date	Quantity	Unit Price	Model
19 Sep 72	123	$ 2,379.00	AQU-10/A
19 Dec 74	129	3,620.00	AQU-13/A
19 Dec 74 (Option)	54	3,614.00	AQU-13/A
6 Jun 75 (Option)	75	3,694.00	AQU-13/A
7 Jul 75 (Option)	23	3,694.00	AQU-13/A

Attachment 1

FORECAST OF SIGNIFICANT PROCUREMENT MILESTONES

Action	Date
Procurement Plan Approved	27 May 75
Determination and Findings Approved	27 May 75
Price Proposals Received	13 Jun 75
Price Analysis/Audit Received	14 Jul 75
Negotiations Complete	25 Jul 75
Contract Writing Complete	1 Aug 75
Contractor's Signature	14 Aug 75
Final Review	18 Aug 75
First Unit Delivered to Southrup	Nov 75

Attachment 2

OLD MIL'S CONTRACT PRICING PROPOSALS

18 June Proposal

Cost Element	Basic Quantity	Option Quantity
Purchased Parts	$ 1,830.00	$ 1,949.00
Direct Engineering Labor	-	4.06
Engineering Overhead	-	6.09
Direct Manufacturing Labor	351.00	370.00
Manufacturing Overhead	527.00	555.00
Other Costs	-	7.25
G & A	344.00	367.21
I R & D/B & P	376.00	401.42
Profit (15%)	514.00	549.30
Total Unit Cost	$ 3,942.00	$ 4,206.33

One time charge for sample testing $20,886.00

6 August Proposal

Cost Element	Basic Quantity	Option Quantity
Purchased Parts	$ 1,797.00	$ 1,908.00
Direct Engineering Labor	35.00	39.08
Engineering Overhead	54.00	60.28
Direct Manufacturing Labor	315.00	332.00
Manufacturing Overhead	485.00	511.00
Other Costs	-	7.25
G & A	352.00	374.31
I R & D/B & P	379.00	402.49
Profit (15%)	512.00	545.36
Total Unit Cost	$ 3,930.00	$ 4,179.77

One time charge for sample testing $21,032.00

Attachment 3

AUDIT REVIEW RESULTS

Cost Element	Costs Questioned: Basic Quantity	Sample Testing	Option Quantity	Total
Purchased Parts	$ 27,067	$ -	$ 40,592	$ 67,659
Engineering Labor	3,492	825	3,621	7,938
Manufacturing Labor	13,869	-	14,599	28,468
Plant Overhead	26,736	1,271	28,059	56,066
Other Direct Costs	-	-	-	-
G & A	9,322	275	11,380	20,977
I R & D	10,034	296	12,249	22,579
Total Costs	$ 90,520	$2,667	$110,500	$203,687

Cost questioned on a per unit basis:

Basic Quantity	$ 90,520 ÷ 158	= $572.91
Option Quantity	$110,500 ÷ 158	= $699.37

Attachment 4

DETERMINATION OF PROFIT OBJECTIVE[1]

1. <u>Contractor's Input to Total Performance</u>

	AF Objective Cost	Weighting (%)	Profit ($)
Purchased Parts	$544,214	3.0	$16,326
Engineering Labor	9,168	12.0	1,100
Engineering Overhead	14,120	7.5	1,059
Manufacturing Overhead	115,725	5.5	6,365
Manufacturing Labor	75,144	7.0	5,260
G & A	207,806	7.0	14,546
Other	5,627	7.0	394
TOTALS	$971,804		$45,050

Average Percentage - - - - - - - - - - - - 4.6%

2. Contractor's Assumption of Contract Cost Risk- - - 6.5%
3. Other Factors- 0 %
4. Profit Objective - - - - - - - - - - - - - - - - - - 11.1%

[1]Note that figures used in this attachment represent total costs for <u>198 units</u> actually procured in October 1975.

Attachment 5

CONTRACTOR PROPOSAL COMPARED WITH AIR FORCE OBJECTIVE
(Based on 198 Units)

Cost Element	Old Mils Proposal	Air Force Objective
Material	$ 585,390	$ 544,214
Engineering Labor	15,615	9,168
Engineering Overhead	24,045	14,120
Manufacturing Labor	102,226	75,145
Manufacturing Overhead	157,368	115,724
Other Costs	5,627	5,627
G & A	116,640	100,084
I R & D/B & P	125,502	107,722
Total Cost	$1,132,413	$ 971,804
Total Profit	169,964	107,870
Total Price	$1,302,377	$1,079,674

Attachment 6

CONTRACTOR PROPOSAL, AIR FORCE OBJECTIVE, AND
NEGOTIATED COSTS AND PROFIT
(For 198 Units)

Cost Element	Old Mil's Proposal	Air Force Objective	Considered Negotiated
Material	$ 585,390	$ 544,214	$ 544,310
Engineering Labor	15,615	9,168	12,114
Engineering Overhead	24,045	14,120	18,471
Manufacturing Labor	102,226	75,145	80,738
Manufacturing Overhead	157,368	115,724	124,504
Other Costs	5,627	5,627	5,627
G & A	116,640	100,084	103,048
I R & D/B & P	125,502	107,722	110,622
Total Cost	$1,132,413	$ 971,804	$ 999,434
Total Profit	169,964	107,870	111,306
Total Price	$1,302,377	$1,079,674	$1,110,740

Attachment 7

INSTRUCTOR GUIDANCE

Old Mil, by chance or design, emerged in an enviable position. The limited time available to procure the avionics sets clearly placed the contractor in a monopoly position. Time did not exist to develop an alternate source since both the retrofit program and the production of the F-6 would have suffered delays. Those delays would have involved costs of a magnitude that would have paled the possible savings of going competitive.

If procurement action had been initiated earlier in the year, and if the various phases of the procurement prior to negotiations had been more efficiently expedited, there would have been less time pressure to come to agreement. The last purchase request was dated 1 March 1975, and the procurement plan written in late May. Examination of the contract files from which this case was taken produced no reason for delaying the start of the procurement for two and a half months. If procurement actions had begun earlier, there might have been significant savings since the contractor was awarded a 6.5 percent profit factor (Attachment 5) primarily as a result of the short delivery schedule.

<u>Suggested Reading</u>

Armed Services Procurement Regulation (ASPR), 3-808.2, <u>Weighted Guidelines Method</u>, pp. 3:140-3:142.

APPENDIX C

SYSTEM PROGRAM OFFICE PERSONNEL

APPENDIX C

TABLE OF CONTENTS

I. AIR RESCUE AND RECOVERY HELICOPTER

INTRODUCTION

While there are no hard and fast rules which prescribe the genesis of a SPO (System Program Office), a SPO Cadre is oftentimes formed during the conceptual phase of the weapon system acquisition life cycle. The SPO Cadre is an embryonic SPO, and is converted to full SPO status after receiving authorization to begin the validation phase of the weapon system's life cycle.

SPO's typically range in size from 25 to 300 or more personnel and are comprised of system managers; system analysts; business, procurement, and contracting specialists; financial managers; program analysts; and, data and program managers. A "typical" SPO organization is depicted in Figure C.1.

The SPO Director directs the weapon system program and the SPO organization itself. He is usually a senior colonel or, in very large or politically sensitive SPO's, a general (as in the F-15, B-1, A-10, and C-5 SPO's). The Director is not only responsible for the technical decisions concerning his system, but for all business decisions as well. Although the contract signature is the responsibility of the Contracting Officer, the SPO Director is the actual and final contractual authority by virtue of his decision-making responsibilities. He is recognized as the focal

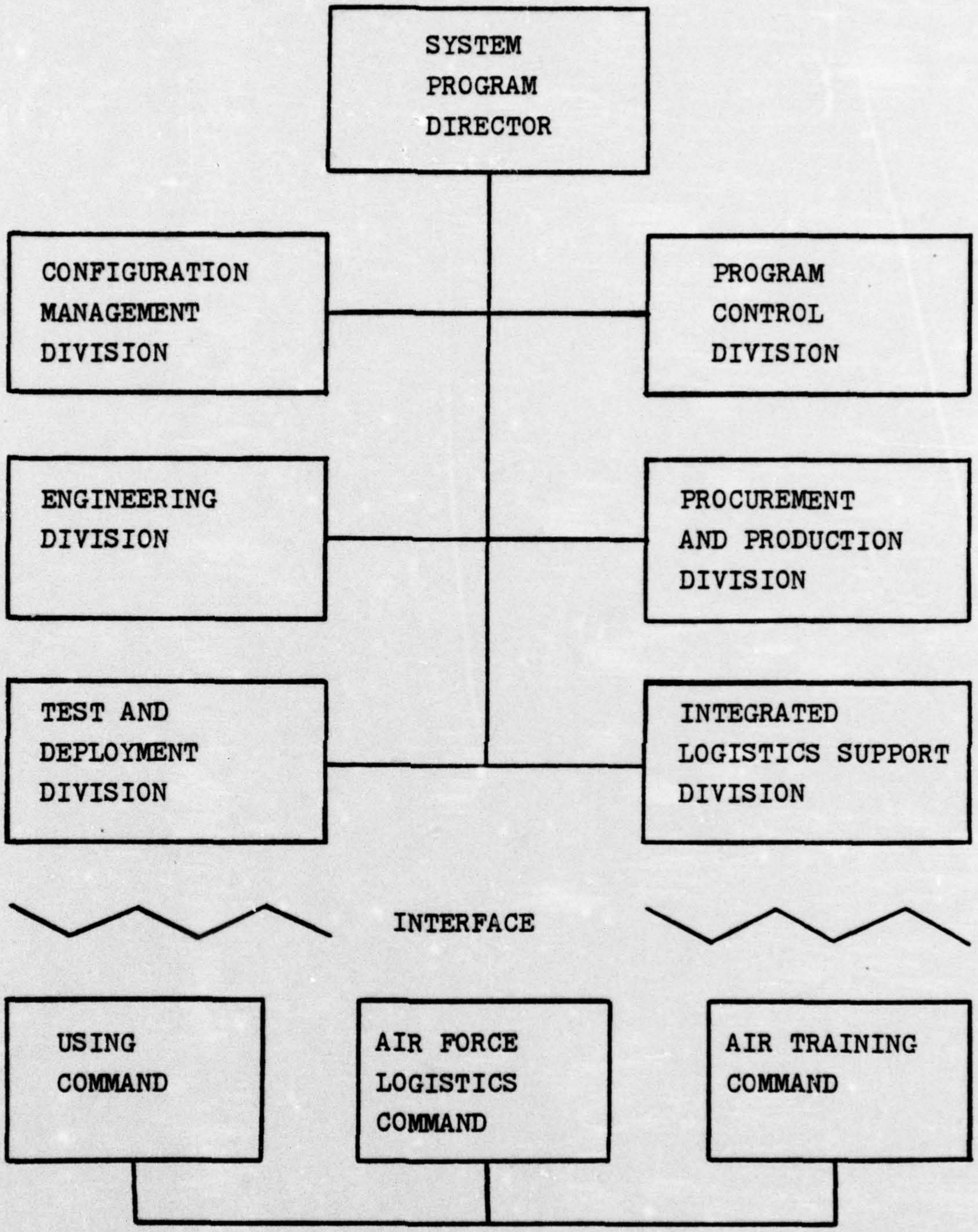


Figure C.1

A "TYPICAL" SPO ORGANIZATION

point for Government-industry interfaces of the program. He is the final change authority for the program (that is, the SPO Director must approve each proposed Engineering Change Proposal).

The Program Control Division is the nerve center of the Program Office through which the SPO Director maintains management control, surveillance, and status of his program. This division operates to insure that all aspects of the program are properly and adequately planned, funded, and integrated. Hence, its activities cut across every aspect of the system program. Through continuous analysis and evaluation of actual performance, this organization provides status and trend information to the SPO Director.

The Configuration Management Division implements the management process which identifies, controls, and accounts for the detailed design of the system. This management process includes the Configuration Control Board (CCB) procedures to assure reasonable control of changes in the design of both system hardware and system requirements. The basic purpose is to assure the effective integration of the various contractors' contributions to the overall system.

The Engineering Division evaluates the contractor's engineering efforts. This includes involvement in system analysis, design of the system, and managing the various elements in the system such as the airframe, propulsion, AGE (aerospace ground equipment), and other configuration items during the entire life cycle.

The Procurement and Production Division performs the contracting and negotiating for the SPO. It is responsible for such production functions as quality assurance, production facility management, and industrial facility management for the Air Force. The Division manages the system GFAE (Government furnished aerospace equipment).

The Test & Deployment Division develops and implements detailed system test and deployment plans. The various types of testing involved include static testing of various parts of the airframe, testing of various subsystems on instrumented ranges, bench testing, and flight testing.

The Integrated Logistics Support Division insures that logistics supportability issues (e.g. support costs, user AGE requirements, initial provisioning, after delivery modifications, etc.) are brought to light throughout the acquisition life cycle and are considered in all pertinent design decisions.

A crucial issue that must be resolved during the inception of any SPO is the selection of Cadre and SPO personnel. Various forces interact to determine initial and replacement personnel selection, including size and import of the system acquisition (e.g. the B-1 vice the T-41 acquisition), the rank and "personal connections" of the Cadre/SPO Director, and the degree to which the system must be developed (e.g. an off-the-shelf buy vice a system conceived at state-of-the-art boundaries).

The following case requires the student to determine the functional areas/specialties/requisite qualifications that might be desirable in a "mini" SPO Cadre. The intent is for the student to wrestle with the realities of a crucial facet of the acquisition process, that of assembling a team of the "best" mix of functional experts to form a SPO Cadre of personnel, subject to authorization constraints. Certainly there is no one optimal mix, i.e. no "right answer" to this case.

An excellent "real life" case, "The H-3 Helicopter Acquisition," is presented in Appendix E. This case illustrates some of the factors that can interact to produce a less than effective cadre of SPO personnel and the resultant mission degradations.

SUGGESTED CLASS PROCEDURE

1. Give each member of the class a copy of the case and divide the class into groups of 4 to 6 members each.

2. Give each group a sheet of flip-chart paper and a felt tip marking pen.

3. Allow each group 20 minutes to determine which functional areas/specialties/requisite qualifications would be desirable and to transcribe these onto the flip-chart paper.

4. Reassemble the class. Tape each list of functional areas/specialties/requisite qualifications on the front wall of the classroom. From these separate lists, a composite list is constructed by the instructor on the blackboard (or another piece of flip-chart paper). As the composite list is constructed, the instructor asks individual group members to explain the rationale for particular functional areas/specialties/requisite qualifications, especially those <u>not</u> held in common among groups.

<u>Estimated student preparation time</u>: 20 minutes.

<u>Estimated class time required (student preparation and presentation)</u>: 50 minutes.

<u>Materials</u>: Flip-chart paper, felt tip markers, masking tape.

AIR RESCUE AND RECOVERY HELICOPTER

Headquarters USAF has directed that an evaluation be made of off-the-shelf, in-production helicopters which could perform the air rescue and recovery mission. Requirements/specifications are:

CREW.	3 (pilot, co-pilot, flight mechanic)
PASSENGERS.	25 (or 15 litter patients plus 2 attendants)
COMBAT RADIUS	200 nautical miles w/5000 lb. payload
CRUISING SPEED.	126 knots
CEILING	15,000 feet
HOVER CEILING	10,000 feet
ENGINES	1 or 2
FEATURES.	all weather capability inflight refueling capability rescue hoist (600 lb.) cargo hook (8,000 lb.)

You have been directed to select a "mini" SPO (System Program Office) Cadre not to exceed 12 personnel. Establish a plan for manning the SPO Cadre by: (1) describing the positions you plan to create; and, (2) specifying the qualifications you will look for in selecting people for those positions. Among the factors you might consider are age, rank, functional experience, specialties, effectiveness

evaluations, education level, and the people the individual must be able to work with.

INSTRUCTOR GUIDANCE

This exercise does not lend itself to one "right answer." Rather, it is designed to stimulate a class discussion of the expertise desired within a SPO or SPO Cadre. The "Introduction" to the case addresses functional areas "typically" represented within a SPO. Among the issues that must be faced when considering establishing a SPO are whether or not desired personnel are available for assignment to the SPO and the reduced availability of personnel information (in light of the Privacy Act of 1974) to the tentative SPO Director.

"The H-3 Helicopter Acquisition" (Appendix E) summarizes an actual system acquisition. A number of personnel-related problems are evident from the H-3 experience, e.g. critical decisions were made concerning system support equipment by people who were totally unfamiliar with rotary wing aircraft. Certainly the "mini" SPO required by the "Air Rescue and Recovery Helicopter" case would benefit from an experienced helicopter pilot (preferably one with experience in the Aerospace Rescue and Recovery Service) in any of the SPO divisions suggested in the "Introduction."

It is interesting to note that the personnel selection policy prevalent in the F-15 SPO is for "bright and aggressive" officers. The feeling is that an inexperienced

officer willing to learn is more valuable than an experienced (specialized) officer who is, perhaps, "inflexible and set in his ways."

Discussion Questions

1) Did the students consider how they would obtain information on the qualifications specified?

2) Was any decision made about the relative weighting of the various qualifications?

II. THE WASP PROGRAM MANAGEMENT TEAM

INTRODUCTION

"Organizational climate" refers to the characteristic day-to-day properties of a particular environment. It is the organization's nature as perceived and felt by those who work in it or are familiar with it. One can think of familiar phrases commonly used to describe an organization's climate, such as "warm," "fast moving," "impersonal," "open," "stressful," etc. These depict an organization's modus operandi.

The System Program Office (SPO) and the Program Office (PO) are similar to any other organization insofar as all organizations are characterized as being composed of individuals and groups striving to achieve goals and objectives by means of differentiated functions which are intended to be rationally coordinated and directed through time on a continuous basis. A unique characteristic of SPO's and PO's, however, lies in their personnel. Generally speaking, the SPO and PO are predominantly manned by functionally expert civilian personnel. The SPO Director and PO manager are usually military; however, below this level, military and civilian personnel commonly supervise one another.

Since both military and civilian personnel are a part of the SPO and PO and work toward the same objectives, their relationships are generally satisfactory. When

problems do arise, however, they often stem from the differences which exist between these two groups and which sometimes tend to divide one group from the other. The military officer is governed by the traditions of military service (traditions that sometimes serve to isolate the military from civilian personnel). Further, he is rotated from one assignment to another, where the civilian's connection with the SPO or PO is more permanent. In some instances, an officer with only limited experience with systems acquisition or program management is the supervisor of a civilian who may possess substantial knowledge and experience in the task. More often, however, the officer is subordinate to the civilian.

Like military officers, the civilians in a SPO or PO are bound by traditions of their own and separated by organizational entities outside the immediate confines of the military structure. For example, civilians are governed by the regulations of the Civil Service Commission and in some instances by non-governmental institutions, such as unions. The overall effect of these outside agencies is to limit the formal institutional authority of military personnel over civilians. For this and other reasons, an officer sometimes feels that it is easier to command troops than it is to manage or work with the civilian personnel who play such an important role in achieving the SPO's mission.

The issue addressed by "The Wasp Program Management Team" is how to resolve behavioral problems of perception, motivation, and communication within a small Program Office. As in all situations in which people are involved, there is no one right solution to the problems raised in the case. The authors suggest one alternative approach to behavioral problem resolution under the section entitled "Instructor Guidance." The important point is that the types of problems highlighted within the case are not uncommon to the SPO and PO environment.

SUGGESTED CLASS PROCEDURE

The following case analysis/presentation technique is suggested:

1. Distribute the case to each student for overnight analysis (recommended time for analysis: 45-60 minutes).

2. During the discussion period, separate the class into work groups of 4-6 members each. Give each group a felt tip marker and flip-chart paper. Allow each group 15 minutes to list existing behavioral problems (perceptions, motivation, communication) and alternative solutions.

3. Reassemble the class and post the group lists on the front wall of the classroom.

4. Address/discuss the lists (15-20 minutes), commenting on similarities and dissimilarities. Ask for group explanations of aspects of the lists that require clarification. Suggest the alternatives found under "Instructor Guidance."

<u>Estimated class time</u>: 50 minutes.

<u>Required materials</u>: Felt tip markers, flip-chart paper, masking tape.

THE WASP PROGRAM MANAGEMENT TEAM

"Jake, I hear I'm getting a new officer assigned to my office," remarked Mr. Ted Poole, Chief of the Wasp Program Control Division.

"Yes," replied Mr. Jake Johnson, Deputy Program Manager, "the major is due sometime today. Rumor from SAC (Strategic Air Command) is that he has a crewcut and is all military."

"Great!" groaned Mr. Poole. "It's bad enough now with the 'Old Man,' let alone having another one on board at the same time."

"Now, Ted, don't make any snap judgments about him until you've had a chance to work with him," advised Mr. Johnson.

"I can't help it, Jake. I've had nothing but problems with these tin soldiers. They always think they're still flying airplanes."

"I know, Ted, but it's unfair to him, yourself, and the organization for you to prejudge him like this," observed Mr. Johnson. "The program manager needs everyone's support if he is going to keep this program alive. You know we're coming up on DSARC II and the chances are 50-50 that the program will survive. We don't want to go back to a

functional job again, especially during the current period of personnel reductions. The program office is the safest place to be today."

"Yeah, sure," muttered Mr. Poole as he left the room. Mr. Johnson shrugged his shoulders and sighed as he turned his attention to the ringing telephone on his desk.

Background

The Wasp program has been in existence for over two years. Colonel Joseph A. Pace, the first program manager, retired just prior to DSARC II. Colonel Pace had been well known and respected by his "team." As one program team member put it, "Everyone loved Colonel Pace. He was calm, easy going, never hurried himself or his people, and never outwardly displayed anger." There weren't any dry eyes at his retirement ceremony.

Colonel John J. Burner was chosen to be the new program manager of the Wasp Program. His selection was based upon an outstanding record as a squadron and wing commander. He is known for his quick, decisive actions and for his ability to drive his subordinates to accomplish the most difficult missions (see Attachment 1 for Colonel Burner's Military Career Brief).

Just prior to assuming his job as program manager, Colonel Burner visited his new supervisors at the Aeronautical Systems Division (ASD). During his visit there, it was implied that the previous program manager had been primarily concerned with his forthcoming retirement from

the Service and that Colonel Burner's new assignment was not only challenging but it was regarded as an opportunity for "an alert program manager to make promotion to general officer." Colonel Burner inferred from the hints and innuendoes around ASD that there was plenty of room for improvement in the Wasp Project, although this was not explicitly stated.

During his first two months as the Wasp Program Manager, Colonel Burner set about the task of shaping up his "program team" to fit his style of leadership. He fired a major in the Program Control Division during his first week at the helm for not having a sense of urgency. The grapevine had it that the officer was fired because he was overweight and sloppy, and not because of inadequate job performance.

After a week of observing the program team function, Colonel Burner called a meeting of all of his key personnel to brief him on the program's operation. During the first presentation by the Systems Engineering Division, Colonel Burner interrupted the briefer and told him to sit down. From that point, Colonel Burner proceeded to lecture his staff on the proper way to brief. Further, he literally gave everyone a tongue lashing as he told them how he was determined to "jack up" the program and get it through DSARC II. The meeting lasted for over four hours as Colonel Burner presented his policy guidance. He emphasized that he did not want any surprises; he wanted facts and he desired

good two-way communication throughout the organization. At the end of the meeting, he asked if there were any questions. As there were none, Colonel Burner dismissed the group. Since that eventful meeting, the coffee breaks and lunch hours have been filled with anxiety as the staff discuss how to cope with the new program manager.

Case Continued

After hanging up the telephone, Mr. Johnson wondered how the new officer, Major Albert A. Flyer, would fit into the program team. He got up from his desk and walked over to the organizational chart (see Attachment 2). He knew that Major Flyer would fill the vacant slot in the Program Control Division, and he hoped the major would have a better fate than his predecessor. He shook his head and wondered just how Ted Poole and Major Flyer would get along. Just then the intercom buzzed. It was Alice Rice, Colonel Burner's secretary, telling him that the colonel would like for him to come to his office and meet Major Flyer. Mr. Johnson reviewed Major Flyer's Military Career Brief (see Attachment 3) before he left for Colonel Burner's office. "Well," thought Mr. Johnson, "at least he's a graduate of the Program Management Course at the Defense Systems Management School." Picking up his favorite pipe, he hurried out of his office for the meeting.

Colonel Burner dominated the first 30 minutes of the conversation as he gave Major Flyer a brief run-down on the program and what he expected of his program team personnel

in the way of job performance. When he was through, he told Mr. Johnson to brief Major Flyer in depth and to introduce the major to Mr. Poole.

As Mr. Johnson and Major Flyer were leaving, Colonel Burner remembered something he had almost forgotten to tell Major Flyer: "By the way, Flyer, while you work for Mr. Poole, I write your OER (Officer Effectiveness Report). Of course, I'll ask Mr. Poole for inputs. I'm really glad to have you on my team, Major."

Before Major Flyer could respond, Colonel Burner turned to Mr. Johnson and said: "Jake, let's you and I sit down tomorrow and discuss how we can convert some of our civilian positions to military."

A startled Mr. Johnson nodded his head and replied: "OK, sir, but I think you may be facing a difficult task."

"What you say may be true," the colonel retorted, "but in my military career I've found the toughest tasks to be the most rewarding."

During his meeting with Mr. Johnson, Major Flyer asked a number of questions about Mr. Poole. He was obviously concerned because he had never worked for a civilian boss before.

"Albert, I'm going to be very candid with you," replied Mr. Johnson. "Ted Pool is a good program analyst, and he has been in the program management business for almost ten years. However, he does have a hang-up about hard charging military officers who still think they're

flying airplanes. The last major who worked for him was an exception and Ted got along just fine with him. But, as you know, when Colonel Burner took over the program, he fired that major for reasons known only to the colonel. This firing has renewed Ted's apprehension of military types in general and you in particular."

"I understand what you're saying, but it sure puts me in a tough spot. If Mr. Poole and I don't get along, my career may be jeopardized by his input into my OER. By the way, Jake, when do I meet my new boss?"

"He should be over to meet you in half an hour or so," replied Mr. Johnson. "He's been in a meeting for over two hours now. While we're waiting for him, here's a copy of his Civilian Career Resume (see Attachment 4)."

Major Flyer's initial meeting with Mr. Poole was satisfactory. Major Flyer did perceive, however, a "chill in the air."

Major Flyer found the first two weeks on the job hectic as he struggled to become familiar with the program. He spent long hours poring over data and attending meetings. He soon realized that his normal working day would be at least twelve hours. He also noticed that Mr. Poole put in only an eight or nine hour day. The other division chiefs seemed to be putting in longer hours. He knew that Mr. Poole was within his rights to go home at normal quitting time. However, he questioned the loyalty and dedication that Mr. Poole was showing the program.

Major Flyer got along well with the other people in the office, but he felt uneasy in the presence of Mr. Poole. When Poole had a task for him, he would always start by saying, "The Colonel or Mr. Johnson wants you to do this or go there, etc." In addition, whenever he went into Poole's office, Major Flyer noticed that Poole's desk was always cleared off with all the papers in the out box. It seemed as if Mr. Poole wasn't doing much work, but was acting like a distribution center and just farming out projects.

Major Flyer was getting along great with Colonel Burner. Whenever the colonel was in his office (the colonel was gone most of the time) he always had a few minutes to talk. In fact, Colonel Burner always had time to informally chat with his officers, but he did not seem to do the same with the civilians.

One day as Major Flyer was reviewing the Source Selection Plan, he discovered that it was lacking evaluation criteria. He realized that this deficiency could adversely impact the source selection process and the program. He decided to bring the apparent oversight to Mr. Poole's attention.

When Major Flyer finished briefing his findings and recommendations to Mr. Poole, Mr. Poole sharply stated, "Look, Major Flyer, I have been in this program business for almost longer than you have been in the Air Force. I worked hard on that plan and the 'Old Man' bought off on it. I

don't want you creating any waves in the front office. It's a good plan and it will do the trick."

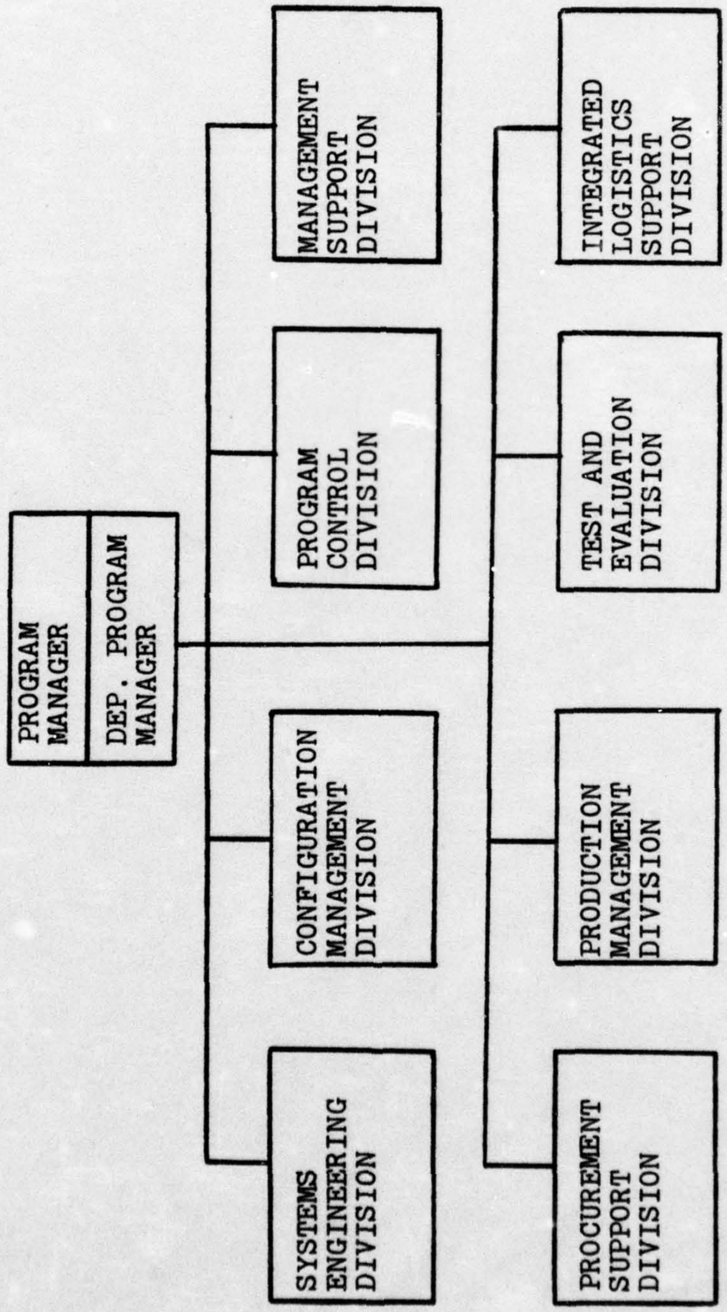
A disheartened Major Flyer left Poole's office even more concerned about his relationship with his boss. He knew that if he went over Poole's head on this issue, he would win his case. But on the other hand, he might lose the war. He would probably jeopardize his efficiency report and consequently his military career. As he pondered his dilemma, the phone rang. It was Mr. Johnson asking if he would like a cup of coffee.

Over coffee Major Flyer and Mr. Johnson discussed the personnel situation in the program. "You know, Albert, I like Colonel Burner," reflected Mr. Johnson. "However, he really makes it tough on me and the other civilians in the program. He is very efficient and he is fair. The problem is that he doesn't warm up to me or the other division chiefs. It is business all the time. Do you know that he very seldom smiles or even asks for something? It's always in the form of an order. I feel rejected and frustrated at times. I don't know what I can do. What do you think?"

"I know how you feel, Jake. I'm in a similar situation with Ted Poole. He and I do business on a formal basis. I have even asked him and his wife to dinner at my home but he begged off. He has always refused my luncheon invitations. He is the first boss that I have not been able to get close to. He treats me like I have a contagious

disease and keeps me at a safe distance. He really acts like I might take his job or something . . . ."

Identify the major human behavior problems that exist in the program management office and suggest ways in which these problems might be resolved.



ORGANIZATIONAL CHART

Attachment 2

MILITARY CAREER BRIEF

OFFICER: Colonel John J. Burner

[redacted]

PROFESSIONAL MILITARY EDUCATION:

Air War College	1971
Air Command & Staff College	1964
Squadron Officer School	1958

CIVILIAN EDUCATION:

United States Military Academy, 1950, BS (Engr)

Northeastern University, 1961, MS (Industrial Engineering/Management

MAJOR ASSIGNMENTS:

1975-Present	Program Manager, Wasp
1972-1975	Wing Commander, 509th Bomb Wing, Pease AFB, N.H.
1969-1970	Air Liaison Officer, 1/5 Mechanized Infantry, Quang Tri, RVN
1967-1968	320th Squadron Commander, 416th Bomb Wing, Griffis AFB, N.Y.
1965-1967	Operations Officer, 320th Squadron, 416th Bomb Wing, Griffis AFB, N.Y.
1962-1963	Stan Eval/Instructor Pilot, 320th Squadron, 416th Bomb Wing, Griffis AFB, N.Y.
1958-1960	Pilot, 320th Squadron, 416th Bomb Wing, Griffis AFB, N.Y.
1952-1957	Instructor Pilot, 3253 Pilot Training Squadron, Reese AFB, Tex.
1950-1951	Undergraduate Pilot Training, Laughlin AFB, Tex.

Attachment 1

AWARDS & DECORATIONS:

Legion of Merit (1OLC)
Air Medal (1OLC)
Bronze Star
AF Commendation Medal (2OLC)

Attachment 1 (continued)

MILITARY CAREER BRIEF

OFFICER: Major Albert A. Flyer

[redacted]

PROFESSIONAL MILITARY EDUCATION:

Defense Systems Management School	1976
Air Command & Staff College	1975
Squadron Officer School	1967

CIVILIAN EDUCATION:

University of Dayton, 1962, BS (Bus Admin)

University of North Dakota, 1969, MBA (Bus Admin)

MAJOR ASSIGNMENTS:

1975-1976	Air Command & Staff College
1970-1974	Air Operations Officer, DCS P&O, Hq SAC, Offutt AFB, Neb.
1967-1969	B-52 Stan Eval/Instructor Pilot, 319th Bomb Wing (Heavy), Grand Forks AFB, N. D.
1966-1967	Forward Air Controller, Republic of Vietnam
1963-1966	B-52 Pilot, 319th Bomb Wing (Heavy, Grand Forks AFB, N. D.
1962-1963	Undergraduate Pilot Training, Webb AFB, Tex.

AWARDS & DECORATIONS:

Distinguished Flying Cross
Air Medal (5OLC)
AF Commendation Medal (1OLC)

Attachment 3

CIVILIAN CAREER RESUME

NAME: Ted Poole

JOB TITLE: Program Analyst

GRADE: GS-14

PRIMARY SPECIALTY: Program Analyst

SECONDARY SPECIALTY: Program Analyst

DATE OF ASSIGNMENT: Jan 1974

[redacted]

CIVILIAN EDUCATION: High School
University of Alabama Center, Decatur, AL, Accounting
Auburn University, Auburn, AL, Engr Drawing

SERVICE SCHOOLS: Equal Employment Opportunity
Contract Price Analysis
Institute for Financial Management
Work Simplification

LAST THREE ASSIGNMENTS:

1974-Present	Chief, Program Control Division, Wasp Program
1969-1974	Chief, Program Control Division, Scat Program
1966-1968	Program Analyst, Fad Program

AWARDS: None

PERFORMANCE APPRAISALS (Weighted Averages):
(Maximum is 4.0)

1976
1975 - 3.6
1974 - 3.8
1973 - 3.9
1972 - 4.0
1971 - 4.0

Attachment 4

INSTRUCTOR GUIDANCE

The Problems

The case alludes to a number of organizational/ behavioral problems. Specifically, individual perceptions and motivations, and interpersonal communications are brought into question and conflict. For example, the civilian program team members apparently have very different perceptions of their boss, Colonel Burner, than do the military team members (Major Flyer). In fact, the perceptions of both civilian and military team members of one another seem to be at odds. Clearly, Major Flyer questions the motivation of his boss, Mr. Poole. And while Colonel Burner stresses the importance and desirability of ". . . good two-way communication through the organization . . . ," he very effectively stifled upward communication from his subordinates during his initial staff meeting. Certainly, communication between Major Flyer and Mr. Poole is strained to an extreme.

The resolution of behavioral problems within the areas of perception, motivation, and communication might be approached in terms of short term and long term solutions. The immediate short term problem centers around the lack of evaluation criteria within the Source Selection Plan. Fortunately, communication seems to be open and candid between

Major Flyer and Mr. Johnson, Deputy Program Manager. Likewise, Mr. Johnson and Mr. Poole seem to communicate openly. An alternative for resolving the problem within the Source Selection Plan might be for Mr. Johnson to approach Mr. Poole; it appears that they are friendly with one another.

With respect to the long term resolution of the apparent behavioral problems, one alternative might be for Mr. Johnson to approach Colonel Burner individually to appeal for a confrontation meeting with the program staff.

Confrontation Meeting

Confrontation is a bonafide organization development intervention technique (Fordyce & Weil, 93-97; French & Bell, 127-129) which is relatively easy to use in cases where a fast overhaul of an organization is desired, especially in times of stress. It has several advantages, as outlined by Fordyce & Weil (95):

--It is speedy.
--The individual becomes more optimistic about working for change because he has more influence over changes and because his own personal needs and goals are legitimized.
--Many persons and several levels of management can participate in such a meeting; consequently the method rallies both deep and broad support for change.
--It is credible and makes sense to those involved.
--It can bring about major, sometimes even dramatic, improvements.

The confrontation meeting approach was developed by Richard Beckhard, and is usually a one day meeting of the entire management of an organization in which they take a reading of their own organizational health. In a series of

activities, the management group generates information about its major problems, analyzes the underlying causes, develops action plans to correct the problems, and sets a schedule for completed remedial work.

The steps involved in a confrontation meeting are (French & Bell, 128-129):

Step 1. Climate Setting (45-60 minutes). The top manager (preferably Colonel Burner, but possibly Mr. Johnson, his number two) introduces the session by stating his goals for the meeting, citing the necessity for free and open discussion of issues and problems, and making it clear that individuals will not be punished for what they say.

Step 2. Information Collecting (one hour). Small groups of seven or eight members (there would be only one group if only the Wasp division chiefs are present) are formed on the basis of heterogeneity of composition; that is, there is a maximum mixture of people from different functional areas and working situations on each team. The only rule is that bosses and their subordinates not be put on the same team. The top management group (Wasp staff) meets as a separate small group during this time. The charge to all the groups is as follows:

> Think of yourself as an individual with needs and goals. Also think as a person concerned with the total organization. What are the obstacles, "demotivators," poor procedures or policies, unclear goals, or poor attitudes that exist today? What different conditions, if any, would make the organization more effective and make life in the organization better?

The groups work on this task for an hour and recorder/ reporters list the results of the discussion.

Step 3. Information Sharing (one hour). Reporters from each small group report their complete findings to the other groups and these are placed on newsprint on the walls. The total list of items is categorized, usually by the meeting leader, into a few major categories that might be based on the type of problem (e.g. communications), type of relationship (e.g. troubles with top management), or area (e.g. engineering division).

Step 4. Priority Setting and Group Action Planning (one hour, 15 minutes). The small groups are reconvened, but this time in functional, natural work teams (if the Wasp division chiefs and the colonel were the only persons in this particular confrontation meeting, Step 4 small groups would, in fact, be one group comprised of the meeting attendees) and are charged with three tasks:

1) Determine problems related to their area, decide priorities, and determine early action steps to remedy the problems.

2) Identify the problems that should be the priority issues for top management.

3) Determine how they will communicate the results of the confrontation meeting to their subordinates.

This completes the confrontation meeting for all the managers except for the top management group.

Step 5. Immediate Follow-up by Top Team (one to three hours). The top management team meets after the rest of the participants have left to plan the first follow-up action steps and to determine what actions should be taken on the basis of what they have learned during the day. These follow-up actions would be communicated to the rest of the management group within several days.

Step 6. Progress Review (two hours). A follow-up meeting with the total management group is held four to six weeks later to report progress and review the actions resulting from the confrontation meeting.

The mitigating circumstances contributing to the possible success of achieving Colonel Burner's support for the confrontation meeting and the meeting's success are the colonel's acknowledged efficiency and fairness and the commitment, i.e. motivation, of Colonel Burner, Mr. Johnson, and ostensibly the rest of the staff, for the success of the Wasp program. As is evident from the six steps involved in a confrontation meeting, Colonel Burner's presence would not be totally necessary, but would be highly desirable. And the meeting size need not be confined to the Wasp staff (division chiefs) although this might also be desirable for the initial meeting.

Suggested Readings

PERCEPTION: Berelson, pp. 141-148.
Suttermeister, pp. 111-142.

MOTIVATION: Berelson, pp. 159-173.
Hayes, pp. 200-205.
Lippitt, pp. 158-170.

COMMUNICATION: Schein, pp. 10-103.
Suttermeister, pp. 278-303.

CONFRONTATION: Fordyce & Weil, pp. 93-97.
French & Bell, pp. 127-129.

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APPENDIX D

MANAGING PROGRAM CHANGES

APPENDIX D

TABLE OF CONTENTS

I. INTRODUCTION

I. INTRODUCTION

Time, cost, and performance are the three basic management parameters for all managers in weapon system acquisition. These parameters are highly interrelated so that a change in one frequently results in changes to the other two. For example, a decision to change the combat radius of a fighter aircraft from 250 miles to 300 miles may extend the scheduled initial operational capability (IOC) date which in turn may increase contract costs due to inflation in the economy and the longer period necessary to pay engineers, keep production lines in operation, etc. The weapon system acquisition manager's job is to determine what effect a given change will have on these parameters; if the change will not cause a major upset of equilibrium, then he can implement it; if the change forces the program far out of equilibrium, he shouldn't.

The equilibrium point for any given program is dependent upon the environment in which the acquisition takes place. For example, the equilibrium point for the acquisition of the Polaris submarine was quite different than that of today's B-1 bomber. In developing the Polaris, the competition for resources was not as great as it is for the B-1; the cold war environment made time and performance much more important than cost. The political and

social environments were more favorably disposed to the needs of the military than they are today. Today's acquisition environment forces the cost parameter to be much more heavily weighted. Therefore, the program manager must be very sensitive to changes that will affect the system cost.

Contract Changes[1]

Changes in the acquisition program generally result in changes to the contract between the defense contractor and the Government. Since the contract is a bilateral agreement, both parties must agree to the changes. These contract changes may be classified into three general categories:

1) Configuration changes that affect the configuration of the system being built for the Government.

2) Task changes which may restructure test programs or feasibility studies.

3) Program changes which generally involve revisions to quantities, technical performance specifications, delivery schedules, or rate of funding.

Though all of these contract changes may affect the cost of the weapon system, program changes usually have the greatest impact on cost. Program changes pose an additional management problem in that they are usually outside the control of

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[1]This discussion is based upon a similar discussion in J. R. Fox's *Arming America* (Boston: Harvard University, 1974), pp. 359-383.

the program manager--the political, economic, technical, and social environments force the change upon him.

As previously stated, the program manager's job is to balance the parameters of time, cost, and performance. When the program change is forced upon him from the external environment, he frequently has no choice but to implement it. Now his task is to implement the change in a way that will not adversely affect the time-cost-performance equilibrium of the program; this presents a challenging task at best.

The two cases that follow focus on the environmental impacts upon the weapon system acquisition process. The first case, "The LR-400 Engine Contract," is a decision case in which the student assumes the role of a Procuring Contracting Officer (PCO) who must decide how to implement a Congressional decision to reduce the number of aircraft in a research and development effort. The second case, "The CX-HLS Aircraft," follows an acquisition from the identification of the requirement to the award of the contract to the winning contractor. The case presents some examples of cost-time-performance tradeoffs and presents a case where the environment has a great deal of impact on the program. The student is asked to identify and analyze these factors.

II. THE LR-400 ENGINE CONTRACT

SUGGESTED CLASS PROCEDURE

A. Distribute the case one or two days ahead of a projected class presentation. Have the class work in teams of two or three students to analyze and prepare a solution to the case. In class, select a team at random to formally brief their proposal. Allow other teams to question and critique the proposed solution. The instructor can summarize by referring to the actual results, carefully indicating that this is not the only logical, or even necessarily the best, solution. The case provides for a thorough analysis of the cost-time-performance trade-off problem.

B. Distribute the case for overnight analysis (recommended time for analysis: 45-60 minutes) and subsequent in-class discussion (recommended time for discussion: 30 minutes).

THE LR-400 ENGINE CONTRACT[1]

The twin-engined A-21 close air support aircraft is presently in the Full Scale Development phase of the acquisition life cycle. The A-21, manufactured by Aerolind Industries of Kansas City, Missouri, had won out in a prototype competition with Dunlop Aviation's A-20 aircraft. Concurrent with the airframe competition, the Air Force had evaluated two essentially similar engines. The competitors were Power System's LR-400 engine and Morgan Corporation's D-7 which were fitted to the A-21 and A-20 respectively.

After considerable evaluation and debate within the Air Force offices involved, the Power Systems engine was selected. Evaluation of the competing engines had revealed essentially similar performance and maintenance characteristics so final selection was primarily based on the approximately 10 percent per unit cost advantage of the Power Systems LR-400.

Lieutenant Colonel (Lt. Col.) Parr had recently assumed the position of Director of Procurement and Procuring

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[1]This case is based on a paper prepared by Captain James J. Dunlap in partial fulfillment of the requirements for a Master of Science degree in Logistics Management at the Air Force Institute of Technology. The authors are responsible for the theoretical development, the conversion of the case into the case format, and the classroom support suggestions.

Contracting Officer (PCO) for the A-21 Systems Program Office (SPO). He had not assumed his present responsibilities until after the award to Power Systems of a contract for 37 LR-400 research, development, test and evaluation (RDT & E) engines. At a price of $30,330,800.00, the Fixed Price Incentive Fee (FPIF) contract also covered Aerospace Ground Equipment (AGE), tests, program management, and data. Further, there were options for (1) long lead-time items, (2) 74 engines, (3) 60 engines, and (4) 171 engines; these options stretched three fiscal years into the future. Progress under the terms of this contract to date had been quite satisfactory, and Lt. Col. Parr had hoped that his other contracts would go as smoothly.

Unfortunately for Lt. Col. Parr, certain members of Congress did not share the USAF's confidence in the Aerolind A-21 as the answer to the close air support mission role. They were, however, not willing to completely cut the program. Acting on the advice of the respective Armed Service Committees (no members of which, Lt. Col. Parr noted, happened to be from Missouri), the House and Senate had directed a change in progress on the A-21 and had affected such action through a cut in the Defense Appropriation on which Lt. Col. Parr's contracts depended. Hence, Lt. Col. Parr had received direction that his long lead-time items funding was withdrawn and the aircraft and engine programs would have to be reduced. Specifically, the RDT & E

aircraft were cut back from twelve to eight resulting in the engine requirement being reduced from 37 to 25.

As a result of this Congressional redefinition of the A-21 program, Lt. Col. Parr's aircraft and engine contracts were no longer consistent with either Congressional authorization or funding. It was clear to him that the contracts would have to be restructured to provide the necessary changes. In anticipation of this, Lt. Col. Parr issued stop work orders to both Aerolind and Power Systems. He had been satisfied with the price originally negotiated and felt that settlement of the restructure could equitably be handled via his obtaining price reductions based upon reduced quantities. Also, he would retain the possibility of purchasing the original quantities through the use of an option.

In line with this plan, Lt. Col. Parr issued a Request for Proposal (RFP) to Power Systems accompanied by a cover letter, the salient parts of which read as follows:

> 1. This RFP further implements subject stop work order. It defines the LR-400 engine program redirection and provides instructions for preparing a definitive proposal occasioned by the restructured program.
>
> 2. The basic objectives of the restructured LR-400 program are (i) to introduce the least amount of disruption to the current engine delivery schedule consistent with the restructured A-21 delivery requirement, (ii) to restructure the remaining program options in a manner which least impacts program costs.
>
> 3. The restructured LR-400 engine program involves (i) a shift in releasing funds for long lead-time hardware, (ii) a prohibition on expenditure of this fiscal

year's funds for the last 12 RDT & E engines, (iii) a change in the engine delivery schedule, and (iv) an option for the above referenced 12 RDT & E engines.

. . . .

5. Your proposal shall be organized into three distinct parts. Instructions for the preparation of each part are set forth below:

a. Part I - Contract . . . .

b. Part II - Contractual Documents . . . .

c. Part III - Cost Proposal . . . .

d. The cost proposal submitted in response to these instructions will be used as the baseline document for the contractual demonstration milestone "Design to Cost" validation. Because the cost proposal will fill two distinct roles, a complete and detailed cost proposal is mandatory.

About a month after the RFP was dispatched, Lt. Col. Parr and his staff experienced second thoughts about the cost proposal instructions they had provided Power Systems. Specifically, they saw that the instructions could be interpreted as allowing a complete repricing of the engine contract, something Lt. Col. Parr certainly did not desire both as a matter of principle, and because recent GAO criticism had led to considerable USAF emphasis in the area of technical evaluation of non-competitive price proposals.

Accordingly, some 35 days after issuance of the original RFP, Lt. Col. Parr sent Power Systems Amendment No. 1 which contained the following instructions:

Cost Proposal requirements are revised by adding the following subparagraphs:

(1) Your proposal shall address the revised LR-400 engine program on a delta cost basis. It shall include a reconciliation between the basic contract (source

> selection) and any definitized changes. It is not intended that any element of the contract not directly affected by the change be readdressed . . . .

After sending this letter, business settled down at Lt. Col. Parr's office while receipt of the Power Systems' proposal was awaited. During this time Lt. Col. Parr had an opportunity to visit the Defense Contract Administrative Services Office (DCASO) that had been established at the Power Systems' main production facility. This facility was supported by three nearby satellite plants, and produced in addition to the LR-400 engine, LT and LW series engines and components for still other Power Systems engines. Most of this effort, as with the LT and LW series, supported civilian engine sales, though it happened that a variation of the LR-400 (approximately 80 percent common) was produced for use in a new U.S. Navy, carrier-based antisubmarine warfare (ASW) aircraft. Lt. Col. Parr's visit was routine, though he had overheard some talk among the DCASO production staff about the stop work order being a "blessing-in-disguise" for Power Systems due to development snags on the LR-400 and difficulty in meeting civilian contract production commitments.

Soon after his return to the SPO, Lt. Col. Parr was rather startled to receive a letter from Power Systems which read as follows:

> We refer to your RFP amendment which requested our proposal on a delta price basis. Please be advised that we recognize no contractual basis for your unilateral action, and under the present circumstances cannot comply with your request. We acknowledge the production options as defined in the current contract as firm commitments.

> We consider any change to the production options as a new commitment that will have to consider the current and forecasted impact of such factors as inflation, material shortages, and energy crisis.

This response caught Lt. Col. Parr by surprise. He had hoped the restructure would go smoothly as he absolutely had to have the entire matter settled inside of five months, as he had been instructed by Hq USAF to be ready prior to the next Defense System Acquisition Review Council (DSARC) meeting. Further, the SPO Director had recently indicated that no exception would be made to the RFP processing requirements set forth in the SPO Operating Instructions--six months maximum.

Soon after Power Systems' letter arrived, a proposal was received which not only represented a complete repricing of the contract without prices for what had been the most distant and largest (171 engines) production option, but included an economic escalation clause as well. At the same time, Lt. Col. Parr received an unsolicited proposal from Morgan Corporation who indicated their willingness to supply the D-7 engine under the same terms and conditions as their original proposal (subject to the inclusion of an economic escalation clause). Their proposal, which included prices for the 171 engine option, compared favorably with Power Systems' new proposal.

As would be expected, Lt. Col. Parr received a variety of ideas about the situation from his staff. Captain Macklin, a cost analyst, pointed out that Power Systems' proposal was not reduced as much as the removal of 12 engines

should have (in his opinion) allowed. He felt that he had detected some basic fallacies in the cost estimation techniques used by Power Systems and that with sufficient time for analysis he could generate enough data to correct the situation. In reply to Lt. Col. Parr's question as to how long that might take, Captain Macklin indicated that in view of the requirement to schedule computer time well in advance, he would need about four, but certainly not more than six months.

Mr. Schwartz, one of the subsystems branch chiefs, expressed the opinion of several of the staff concerning the economic escalation clause. (Obviously, all contractors would desire such a provision since it had just been officially authorized in Defense Procurement Circular 120 that came out the same week as Lt. Col. Parr's RFP amendment.) Mr. Schwartz pointed out that Power Systems already had three year labor and materials contracts negotiated, and that he was not aware of any major problems concerning these contracts. Further, this was not a new contract situation and the changes being made were not even major ones.

Lt. Col. Parr also received an urgent letter from his DCASO office pointing out the advantages of the current contract. Their point was that in view of inflation, etc., the USAF could only lose by allowing Power Systems to reprice the contract. The DCASO went so far as to suggest that the commonality factor between the Air Force LR-400 and

the Navy version would make it feasible to simply withdraw the stop work order and continue under the present contract structure.

Lt. Col. Parr had consulted with the Aeronautical Systems Division (ASD) procurement policy and legal offices, and had received similar replies. "We haven't really come across one like this before . . . we trust your judgment so just decide what you want to do and we'll send over a memo for your file." He worried that what happened on this contract could set a precedent for his other A-21 related contracts. In the past he had learned to look to guidance such as that contained in the contract General Provisions for support for his contract interpretations. He was not sure in this case which sections might apply, but thought that somehow the Stop Work Order, Changes, or perhaps Termination for Convenience ought to be related to his problem. It would certainly simplify matters if he could simply "look up" the answer. Finally, as if things were not bad enough, he had just received word from the Air Force Systems Command Directorate of Systems Procurement that the Directorate had designated individuals to become thoroughly conversant with major SPO programs and that the A-21 designee would be visiting next week and had requested a complete briefing on Lt. Col. Parr's activities.

Prepare the briefing for the AFSC "Visiting Fireman," and include the most appropriate suggested solution out of

this dilemma. Be prepared to support your judgment with logical, well-thought-out arguments.

INSTRUCTOR GUIDANCE

Possible Solutions

The actual solution employed in this situation was to negotiate a new contract with Power Systems under essentially sole-source conditions. Due to the time, effort, and money already invested in the LR-400 engine by the Government, the contractor could be quite sure that acceptance by the Government of his point that the PCO would not tell him how to price the new RFP would not lead the Government to redo the source selection. A reaccomplishment of source selection under competitive conditions might have caused a delay of the DSARC, so that the PCO would have been under considerable political pressure--internal as well as external--to stay with Power Systems.

The heart of the problem dealt with the issuance of a stop work order and the Air Force action to reduce quantities of engines to be procured under the first phase of the contract. A major purpose of this case was to point out that there really is no place for the PCO to "look up the answer" in a case like this. According to the Stop Work Order clause, issuance of a stop work order is supposed to be followed by a cancellation of the order and continuation of the contract, or by termination either for convenience or for default. In this case, the PCO did none of those things

but instead issued a Request for Proposals to obtain revised prices based upon the change.

A review of the Changes clause would reveal that it is specifically applicable to changes made within the general scope of work of the basic contract. A reduction in the quantity of engines to be ordered would not really fall within this category. Therefore, the contractor was correct in his observation that there was no contractual basis for the PCO's unilateral direction as to how to price the new proposal.

Additional Comments

Any solutions to this problem should focus on the impact upon the time-cost-performance parameters. For example, a decision to award the contract to Morgan Corporation should consider the impact on the program schedule as well as possible interface problems for the A-21 contractor.

Recommended Reading

Armed Services Procurement Regulation Manual (ASPM No. 1), Section 9A, Contract Changes.

ASPR, Stop Work Order, Changes, and Termination for Convenience clauses.

III. THE CX-HLS AIRCRAFT

SUGGESTED CLASS PROCEDURE

A. Distribute the case for overnight analysis (recommended time for analysis: 60-90 minutes) and subsequent in-class discussion (recommended time for discussion: 45-60 minutes).

B. Distribute the case for written analysis. The total analysis should not exceed two pages (recommended time for analysis and write-up: 120-180 minutes).

C. Have one team of 2-3 students (selected at random) present a formal 15-minute presentation analyzing the case. Other students critique. Instructor summarizes.

THE CX-HLS AIRCRAFT[1]

Shortly after his inauguration, President John F. Kennedy presented the strategy of "flexible response" in his first State of the Union message. Among other things, he asked the Secretary of Defense, Robert S. McNamara, to initiate steps for increasing military airlift capability to comply with this strategy. This would:

> better assure the ability of our conventional forces to respond, with discrimination and speed, to any problem at any spot on the globe at any moment's notice. In particular it will enable us to meet any deliberate effort to avoid or divert our forces by starting limited wars in widely scattered parts of the globe.

The Requirement[2]

On 6 October 1961, the Military Air Transport Service (MATS)[3] received a Qualitative Operational Requirement (QOR) from Headquarters United States Air Force (Hq USAF) concerning a replacement for the Douglas C-133 Cargomaster.

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[1]This case is based upon a thesis prepared by Major Jerry V. Poncar and Captain James R. Johnston II in partial fulfillment of the requirements for a Master of Science degree in Systems Management at the Air Force Institute of Technology. The authors are responsible for the theoretical development, the conversion of the case into the case format, and the classroom support suggestions.

[2]See Figure D.1 for a chronology of events.

[3]MATS has since been redesignated Military Airlift Command (MAC).

1961		
January	-	"Flexible Response" policy initiated requirement to increase military airlift capability.
October	-	Hq USAF issues QOR to MATS.
1962		
January	-	SECDEF outlines general objectives for deployments to possible limited war contingency areas.
February through December	-	MATS enlarges on QOR to recommend an aircraft capable of carrying 100,000 pounds of outsized cargo 4,000 nm at a speed of Mach .8 by FY-1968.
1963		
June	-	Hq USAF issues SOR for a heavy logistics aircraft operational during the 1968-1980 time frame.
November	-	AFSC issues draft ADO for CX-HLS capable of carrying 100,000 pounds 10,000 nm unrefueled with an IOC of 1971.
December	-	CX-HLS SPO formed.
	-	MATS Commander reemphasizes IOC date no later than FY-1969.
1964		
May	-	SECDEF issues force guidance with a NLT IOC date of CY-1969.
	-	Hq USAF amends SOR to 4,400 nm range and confirms IOC date.
June	-	Parametric study contracts negotiated.
July	-	TPP concept introduced to CX-HLS SPO.

Figure D.1

CX-HLS CHRONOLOGY

August	- Advanced development contracts to two engine contractors.
	- AFSC revises definition phase schedule to comply with CY-1969 IOC date.
October	- ASD presents parametric study reports and PTDP to AFSC and Hq USAF.
December	- SECDEF gives conditional approval for development.
	- SPO issues RFPs and contractors respond.
	- Hq USAF authorizes initiation of Phase 1B.

<u>1965</u>

January	- TPP officially tied to CX-HLS program.
April	- Proposals arrive at SPO and evaluation phase begins.
August	- Engine contractor selected.
	- SSSB findings presented to SAF recommending Contractor A.
September	- Contractors revise proposals.
	- Contract awarded to Contractor B based on least cost.

Figure D.1 (continued)

CX-HLS CHRONOLOGY

During January 1962, Defense Secretary McNamara discussed, before the Senate Committee on Armed Forces, a series of general objectives for deployments to most limited-war areas in the Fiscal Year (FY) 1963-67 time period. To meet the airlift requirements projected by Secretary McNamara, MATS enlarged upon the QOR to recommend a Multi-Purpose Long Endurance (MPLE) aircraft capable of carrying 100,000 pounds of outsized cargo 4,000 nautical miles at a speed near Mach 0.8. A "conservative estimate" indicated a need for 157 MPLE aircraft operational in FY 1968.

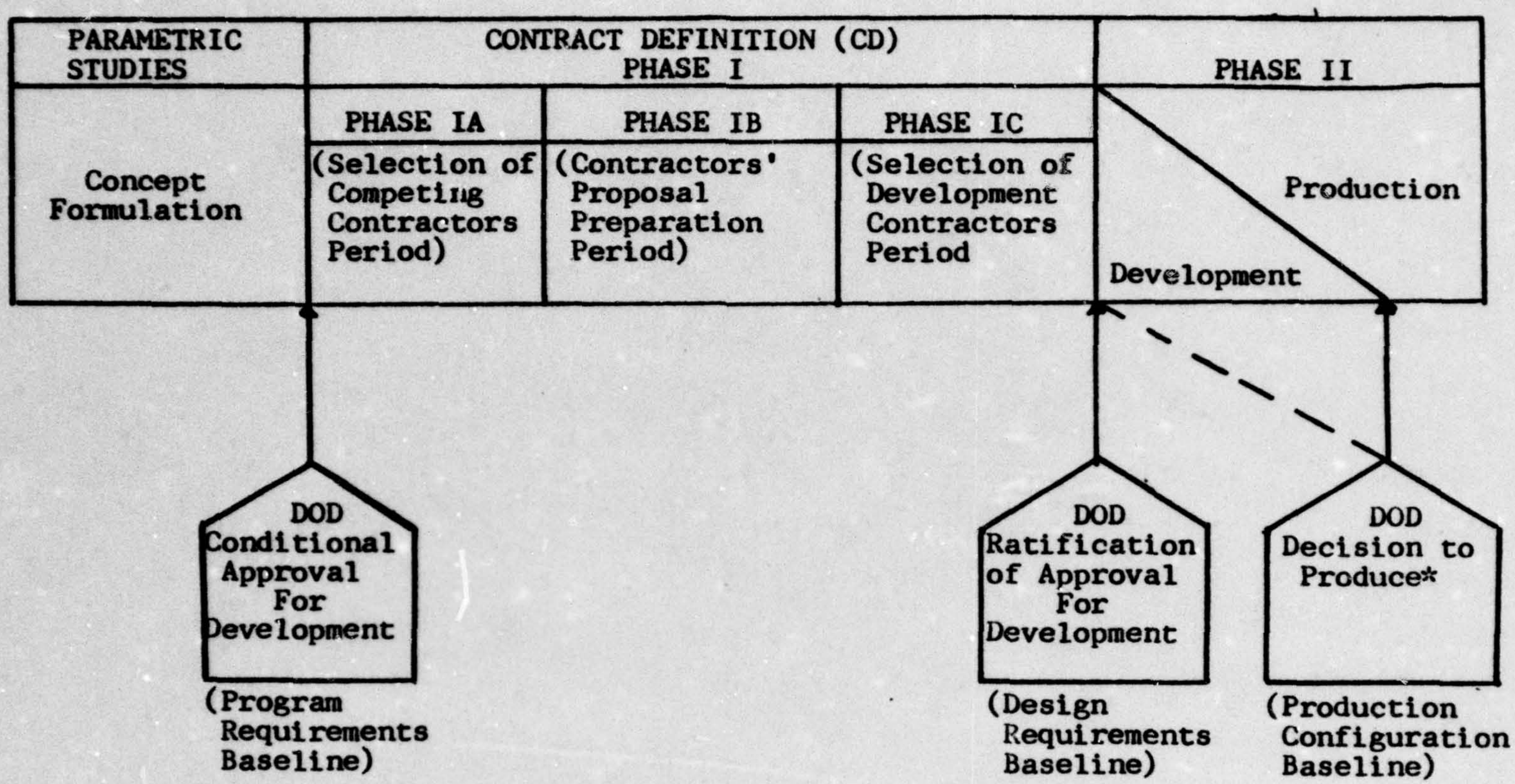
A Specific Operational Requirement (SOR) was drafted on 20 June 1963 by Hq USAF for a Heavy Logistics Aircraft Support System operational during the 1968-1980 time period. On 29 November 1963, the Commander, Air Force Systems Command (AFSC) sent letters to the Air Force Chief of Staff and the Commander of MATS stating that the design objectives of a long range heavy logistics transport (now called CX-HLS) had been resolved to the point where a development program should begin. A draft Advanced Development Objective (ADO) was attached to each letter providing broad guidance for the initial stages of the program and a preliminary schedule of proposed actions. The CX-HLS described in this ADO would be capable of carrying 100,000 pounds, 10,000 nautical miles (nm) without refueling, using state-of-the-art turbofan engines and an advanced aerodynamic wing. The first flight would be in 1969, and the Initial Operational Capability (IOC) date would be late 1971.

The Chief of Staff was also requested to provide $2.0 million in FY 1964 funds to finance three airframe and three propulsion companies to perform parametric studies starting 1 February 1964 and finishing during early August. These studies would provide the basis for the Technical Development Plan (TDP) and the Request for Proposals (RFP) which would initiate the Program Definition Phase (PDP)[4] later in August. It was anticipated that propulsion technology would be the "pacing element of this system"; therefore, early approval of an engine study request made to the Air Staff on 12 November 1963 was essential.

Another letter from the Commander AFSC was sent to Aeronautical Systems Division (ASD) designating them as lead division for preparation of plans and management action through the acquisition phase of the CX-HLS. In response to this letter, the CX-HLS Project Office was established on 9 December 1963.

<u>The IOC Debate</u>. On 13 December 1963, the AFSC Commander received a letter from the MATS Commander expressing appreciation that the need for a heavy logistics support aircraft had been recognized. However, referring to the June SOR, he stated that an IOC no later than 1969 was absolutely essential. The 10,000 nm range made possible by the proposed

[4]The acquisition life cycle terminology in use at the time of the CX-HLS acquisition is shown in Figure D.2.



*The production decision, for at least initial production quantities, may be made concurrently with the development decision; hence, the dotted line.

Figure D.2

PHASES OF THE WEAPONS ACQUISITION PROCESS

wing design would probably have to be sacrificed because of its lack of reliability under current technology levels.

The AFSC Commander pressed for an IOC date in the 1971-72 time frame. He was concerned that unless the CX-HLS could carry 100,000 pounds for 10,000 nm using the technological advancements of the 1960's it would just be another interim airplane. The proponents of an IOC date in 1969 proved to be more influential as reflected in the Tentative Force Guidance provided by the Secretary of Defense.

The Secretary of Defense established future airlift alternatives A and B in a Tentative Force Guidance on 16 May 1964. Alternative A would be an airlift force structure composed primarily of C-141's supplemented by ageing C-124's and C-133's. Alternative B consisted of thirteen C-141 squadrons and six CX-HLS squadrons. Secretary McNamara tentatively approved alternative B pending results of the parametric studies in August. His guidance concerning the IOC date was unmistakable:

> I cannot emphasize too strongly, however, that the attractiveness of alternative B rests primarily on its ability to meet a valid airlift requirement of significant size in the post-1968 period at lower total systems costs (including manpower) than by continuing to procure C-141's. The ability to provide outsize lift as well is a highly valuable byproduct, but would not of itself justify so expensive a program for the small force required. This means that a delay in CX-HLS operational availability beyond the end of CY-1969 would seriously jeopardize the program.

On 25 May 1964, Hq USAF amended the June 1963 SOR repeating the operational period of 1968-1980 and increasing the range to 4,400 nm with the 100,000 pound payload. AFSC

began an intensive effort to compress its schedule which had anticipated an IOC during the third quarter of 1971. On 1 June, the Research and Technology Division (RTD) was requested to immediately assess the possibilities of developmental compression, especially in the propulsion systems. They responded that an approximate twelve month compression could be achieved with an additional $15 million in FY-1965 funds and an expected decrease of 5 percent in propulsion performance.

Parametric Study Proposals. While the IOC debate was going on, the CX-HLS System Program Office (SPO), made up of two military officers and three Government Service civilians, received five airframe and three engine study proposals on 18 May 1964. On 5 June, parametric study contracts were negotiated with three of the five airframe contractors and two of the three engine contractors. These studies were to be completed on 15 September, which was a schedule slippage from the "early August" date specified by the AFSC Commander.

Although parametric studies were not to be completed until 15 September, Secretary McNamara's evaluation of alternative B was still to be conducted on 1 September based on the studies' progress reports of 1 August. The RTD Commander assigned top priority to all action pertaining to CX-HLS engine development. The definition phase schedule was revised to reflect an IOC date of CY-1969. The final planned definition phase schedule is itemized below:

20 August 1964:	PCP (Program Change Proposal) with revised PTDP (Proposed Technical Development Plan with description of Program Definition Phase) to Air Staff;
1 September 1964:	PCP with revised PTDP to SECDEF;
15 October 1964:	Airframe/Propulsion studies data to SECDEF as addendum to revised PTDP, as added info for decision makers;
1 November 1964:	System Definition Directive reviewed (requested in September PCP to SECDEF);
2 November 1965:	RFP's for PDP released;
1 December 1964:	Contractor proposals for PDP received with definitive contract that contractor is willing to sign attached;
1 January 1965:	Contracts signed;
1 May 1965:	Phase II proposals received;
1 June 1965:	Phase II proposals' evaluation complete;
1 July 1965:	PSPP (Proposed System Program Package) forwarded for acquisition phase approval;
1 August 1965:	System program directive issued.

SPO manning problems. In July, a new Commander was assigned to ASD. The new Commander took special interest in the CX-HLS SPO as it acquired greater responsibilities. He wanted this office to be located in the same building as the C-141 SPO so that lessons learned on the C-141 could be quickly applied to identical functional areas of the CX-HLS. He also suggested transfer of experienced people from the C-141 to the CX-HLS as the C-141 program began to phase down.

Nevertheless, manning was a critical problem, especially for the Program Control section. Even people assigned from the C-141 and other SPO's had their most recent experience in day-to-day operating management and few were prepared for the unique requirements of the definition phases. Personnel associated with the SPO also had to acquaint themselves with a new series of regulations which were evolving during this time period and would serve as the guide for management of the CX-HLS program. An added factor was the introduction of the new Total Package Procurement (TPP) concept and indications that the CX-HLS program would be the first to use it.

Total Package Procurement. Total Package Procurement evolved from attempts to eliminate the problems of delay, cost escalation, performance failures, and logistic support deficiencies experienced with previous government procurement methods. The TPP concept integrated into a single contract the development, production, and as much support as possible over the operational life of the system. Its basic objective was to extend competition throughout the entire weapons acquisition process by encouraging qualified defense contractors to compete for the total package at the outset. Contrasted with previous practices of diffusing contractual responsibility over separately negotiated contracts for development, initial production, and multiple follow-on contracts, the new concept would make the competitively successful contractor singularly

responsible for the total cost, performance, and operational availability of a stated number of systems.

In this competitive atmosphere, contracts could be awarded under conditions where performance and schedule would be related to price on substantially all of the program. Incentive contracting in the form of fixed price incentive fee (FPIF) contracts would enable the winning contractor to improve his profits, if he performed well. A flexible incentive formula allowed the contractor to adjust the cost sharing ratio within prescribed limits to reflect his views of the future program risk environment. This would allow the efficient contractor the opportunity for increased profits and provide him with the greatest motivation to control and improve upon development and production costs while maintaining reasonable protection from unusual risk.

The anticipated benefits of TPP were:

1. It inhibited "buy-in" bidding including overestimates of performance and underestimates of cost which, previously, had led to performance disappointments, budget disruptions, and schedule changes.

2. It motivated the contractor to design for economical production and for reliable and simple maintenance of operational hardware from the outset. This would minimize production redesign and maximize efforts to capitalize on cost reducing production techniques. Lower initial production costs would then lead to lower take-off points on the learning curve for subsequent production runs. For the same reason, the contractor would be motivated to obtain supplies and services from the most efficient sources.

3. It decreased the need for competitive reprocurement of components from other contractors thus leading to decrease in risk concerning the integrity of the system and avoidance of complicated logistic problems.

4. It allowed the Government the opportunity to select contractors based on binding commitments to performance and price of operational equipment, rather than just mere estimates.

5. It required a tightening of design configuration, both in the specifications on which the competitors submitted proposals and in the work under contract. This required government procuring agencies to be more specific from the outset in spelling out to industry what was wanted and as a result, it led to a system which was better defined prior to allocating substantial resources to it.

6. It provided a competitive environment which presented advantages to both the buyer and the contractors. The winning contractor was forced to be efficient. Through this necessity, he was better prepared to compete for future military business and in other markets, while the Government reaped some of the benefits of his improved efficiency.

Although TPP was not officially tied to the CX-HLS program until February 1965, SPO personnel were being briefed on its implications as early as July 1964. These briefings were held to insure proper preparation of RFP's which would permit competitive proposals from industry covering development and production in one contract. To successfully use TPP, it was first necessary to define the performance requirement for the system in detail and with a high degree of accuracy; secondly, the major technologies of the system must be in hand. Only with these requirements could competitive commitments concerning performance and price be obtained.

Parametric Study Results

The parametric studies consisted of four formidable tasks; parametric analyses, design analysis, system performance, and program planning. Important innovations such as drive-through loading, high flotation gear, propulsion

selection, and cargo compartment size were defined and evaluated. A cargo compartment floor area of 2400 square feet was found to be more cost effective than the 1750 square feet considered in the original SOR. Also, a new high bypass ratio engine capable of developing approximately 40,000 pounds of thrust would be preferable to any cluster arrangement of six or eight conventional TF-33 engines, or any modification of conventional engines. These new engines were still considered the most uncertain factor of the program. On 7 August 1964, before the parametric studies were completed, contracts were awarded to the two engine contractors for advanced development and testing of propulsion components. The contracts were written to provide for termination during October 1964 in the event that the program would be cancelled.

Soon after completion of the parametric studies, another schedule compression was attempted by deciding to retain all three airframe contractors in the contract definition phase rather than conducting a time-consuming source selection eliminating one of the competitors. Increased competition was another benefit of three, rather than two participants. An additional $7.0 million of FY-1965 funds were requested to finance participation of the third contractor.

From the parametric study results, the Preliminary Technical Development Plan (PTDP) was prepared. Included in the PTDP was the first total program cost estimate for

120 aircraft of $3,116 million. An ASD team presented the final parametric study report and PTDP to Hq USAF and Hq AFSC on 14 October. These documents established the program requirements baseline and marked the end of the conceptual phase. On 4 December, the Secretary of Defense tentatively approved further development for at least a three squadron force.

Contract Definition--Phase 1A

Simultaneously with preparation of the PTDP, definition phase 1A began with preparation of the RFP. Personnel from the SPO, the newly formed Source Selection Evaluation Group (SSEG), MATS, ATC, AFLC, and other ASD organizations combined efforts to prepare an RFP covering the remaining definition phase and acquisition of the system. Their efforts were complicated by the requirement to incorporate the new series of directives which were still in the process of being finalized. In addition, the TPP concept was utilized, and for the first time, a model contract covering the entire program was included in each RFP. This RFP was submitted to Hq AFSC for review and approval on 14 October 1964. After being returned to the SPO twice for considerable revision, the final 1,287 page RFP was released to the three airframe contractors on 11 December, 39 days after the scheduled date.

The CX-HLS SPO was immediately inundated with questions regarding the complex RFP. However, few questions concerned the immediate problem of a proposal for the conduct

of the two remaining phases of contract definition, so that the contractors submitted their proposals on 21 December 1964. On 31 December, Hq USAF authorized the initiation of phase 1B--project definition. On the same day, definition contracts were awarded to the three airframe contractors and the two engine contractors marking the end of phase 1A.

Phase 1B

The SOR was revised again on 5 January 1965 to reflect the parametric studies and provide a base line for the contractors' definition efforts. Although these technical objectives were fairly well understood, questions concerning systems analysis, the procurement concept, and cost proposal preparation continued to pour into the SPO. Extensive bidders' briefings were held and an additional 761 questions were formally answered. Often these answers precipitated changes in the RFP. Technical objectives were also subject to change. A larger aircraft evolved as being more cost effective. Therefore, a mid-February RFP revision called for 2700 square feet of loadable floor area rather than 2400. Several weight reducing changes were needed to maintain gross weight requirements.

DOD Directive 7200.4. Another significant cause of RFP changes was a disagreement about compliance with DOD Directive 7200.4 dated 21 May 1957. This directive essentially limited funding of multi-year programs to Fiscal Year increments. When total package procurement was considered for

implementation during the conceptual phase, the ASD staff found a deviation to DODD 7200.4 would be necessary to allow funding for work package increments. First mention of this was made in a 5 August 1964 briefing, and reiterated in several briefings and letters thereafter. The RFP assumed the deviation from 7200.4 would be approved and it had been reviewed by the Assistant Secretary of the Air Force for Installations and Logistics (ASAF (I & L)). When the SPO was informed on 15 February 1965 that a deviation would probably not be approved, the ASD Commander sent a personal telegram to the Commander of AFSC specifying changes that would be necessary in the RFP and the possibility of a 60 to 90 day delay in phase 1B. Nevertheless, Secretary McNamara's memorandum on 25 February stipulated that 7200.4 would be followed completely. Extensive changes in the RFP concerning work package statements were completed by the SPO and forwarded to the contractors on 9 March. Altogether, 294 RFP changes were made during phase 1B with no changes in reimbursements to the contractors and little adjustment of the schedule. These changes, plus the understandable competition for the potential follow-on commercial development, caused each airframe contractor to expend an estimated \$8 to \$15 million in excess of the \$7.125 million of government money each was allowed. One engine contractor alone acknowledged spending \$700,000 more than funded.

<u>Further schedule changes</u>. On 8 January 1965, the first of a series of meetings occurred in the office of ASAF (I & L)

to further review possibilities of schedule compression. The SPO suggested early engine selection to simplify the air vehicle evaluation and source selection, but optimum consideration of cost effectiveness trade-offs required that engine evaluation remain concurrent with the airframe. This meant that for the airframe alone, there would be eighteen proposals to evaluate. Each of the contractors offered proposals for each different propulsion system; and each of these proposals was varied for three different cost-sharing formulae. Still, there was concern at the Secretarial level for shortening the evaluation phase. The schedule reflected in the RFP called for firm proposals from the contractors on 1 April and contract award on 1 August 1965. The SPO considered this schedule to be a severe compression of an originally planned 14 month PDP. The ASAF (I & L) felt that the time allowed for evaluation was excessive and needed to be shortened to preserve the 1969 IOC date. On 15 March, the SPO presented an extensive PERT network showing that the very earliest contracts could be forwarded for Secretarial review would be 4 September 1965.

Dates for final guidance to the contractors were changed to 23 March for the air vehicle and 6 April for the engine. On these dates, clarifications to the RFP's (which were significantly larger than the original documents) were distributed to the contractors. All contractors were to submit their technical proposals on 20 April and cost proposals on 27 April, marking the end of phase 1B.

The Independent Cost Estimate

During the first three months of 1965 the Air Force developed their own estimate of CX-HLS program costs. Original RFP specifications were used to develop an estimated range for both airframe and engine costs. These cost estimates were based on historical engine and airframe data in general, and were independent of any specific competing contractor's experience.

These estimates were to be used in evaluating the cost reasonableness of each contractor's proposal during source selection, and to provide the Air Force with a negotiating tool when the contracts were finalized. They were also to provide the first total estimate to the Air Force for all costs that would be included using the total package procurement concept.

The independent cost estimate was completed in April and the predicted airframe cost for 115 aircraft fell within a range of $2,100 million to $2,400 million. This was based on an aircraft system whose final gross weight would be 664,000 pounds, with a 5,600 square foot wing area, and a cargo compartment floor space of 2,494 square feet.

Phase 1C

Preparation for the evaluation phase, 1C, began on 16 November 1964 when the System Source Selection Board (SSSB) was established with the Commander of ASD as Chairman. On 6 March, the first meeting of the Source Selection Evaluation Group (SSEG) was held. This group, which would

eventually number approximately 500 people, would present its findings to the SSSB. The Board would then present its recommendations to the Commanders, the Air Council and the Source Selection Authority, the Secretary of the Air Force (see Figure D.3). Practically every member of the SPO was directly involved in selection activities.

During the week of 20-27 April an estimated thirty-five tons of proposals were delivered to Wright-Patterson AFB. Page counts of the technical/management areas alone varied between 40,000 and 50,000 per proposal. Thirty items were evaluated and each was divided into factors and subfactors. A narrative had to be written to support the raw score assigned to each factor. Complete security was necessary to avoid advance indications of the eventual winners. Intensive technical evaluations by various government agencies were used to validate performance claims of each contractor. An attempt was made to differentiate between ten year operation and maintenance costs, although AFLC had no historical records applicable to this type of evaluation. The sheer mass of data resulted in approximately 600 discrepancies and deficiencies which had to be negotiated as changes to the contractors' proposals.

<u>Selection of engine contractor</u>. On 21 May 1965, the SPO initiated a letter recognizing that the developmental contracts with both engine manufacturers would expire on 15 July, well before the anticipated contract award date. Continued development was essential to the 1969 IOC. The

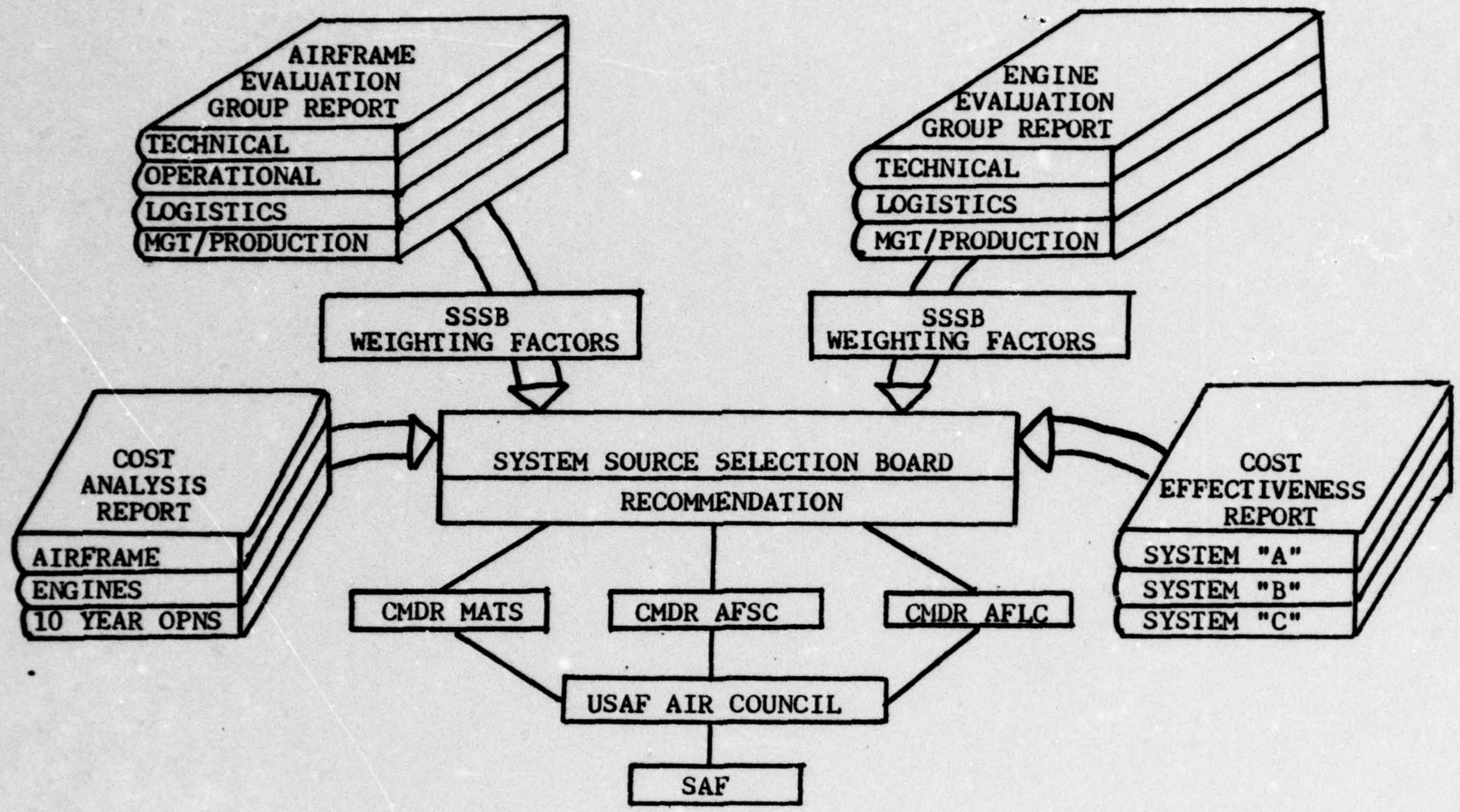


Figure D.3

SOURCE SELECTION RECOMMENDATION FLOW

SPO repeated its earlier suggestion of advanced engine selection, and estimated a choice could be made in early August. Approval was granted in early June, and a schedule was published establishing 27 July as a tentative date for SSSB recommendations to the Air Council and Secretary of the Air Force. During the week of 13-21 July the SSSB briefed the Air Council, Chief of Staff, and Secretary of the Air Force on its evaluation. Contractor C's engine, with its higher bypass ratio, was judged to have general technical superiority and was essentially chosen on 6 August, when developmental funding of the engine was halted. The eventual engine contract incorporated the 85/15 flexible cost sharing formula and established a target price of $459 million for engines to equip the first 58 airframes.

Selection of airframe contractor. The definition contracts with the airframe manufacturers also expired on 1 August. On 2 August, Supplemental Agreement #2 was issued financing each contractor's continued developmental efforts at the rate of $125,000 a week. By 6 August, detailed discussions with all three airframe contractors had progressed to the point where the following schedule was established:

Contract negotiation with all contractors complete.	14 August
Contract writing complete	24 August
Contractor signatures complete.	1 September
ASD/AFSC review complete.	4 September

The evaluation of such a large number of measures tended to normalize the scoring so that total scores were generally quite close. This made it difficult to award the

contract to other than the lowest cost proposal. Of the two best proposals, Contractor A submitted a target price $437 million above that of Contractor B. The SSSB's assessment of probable cost, excluding profit, was $2,055 million for Contractor A and $1,860 million for Contractor B. However, the SSSB unanimously recommended that Contractor A be selected on the grounds that the configuration proposed was a very well-ballanced and aerodynamically effective design which met all RFP requirements. Therefore, it would offer the least risk in terms of cost, performance, and schedules. Contractor B's proposal did not meet all of the RFP requirements, specifically the takeoff and landing requirements. The third contractor's design was judged incapable of meeting most of the RFP requirements. These findings were presented to the Secretary of the Air Force (SAF) and the Air Council on 23 August 1965.

<u>The 4 September proposals</u>. Subsequent to the evaluation of the basic proposal data, the SPO was directed to discuss the areas of greatest concern to the Air Force with each of the contractors. This was done "to assure to the greatest degree possible" that there was a full understanding of both the Air Force requirements and the proposals. This was accomplished on 1 September. Contractor A was told that their price was of greatest concern; Contractor B was told their proposal was incapable of meeting the takeoff and landing requirements; the third contractor was told their present design was incapable of meeting most of the RFP requirements.

On 4 September, each contractor submitted revised proposals. Contractor A lowered its target price $100 million and made very minor technical changes. Contractor B submitted a substantially redesigned aircraft with wing area increased from 5,600 square feet to 6,200 square feet, a different flap arrangement, and improvements in engine inlet and thrust reverser design. The third contractor submitted major changes, but they were eventually judged to still be insufficient. Although Contractor B claimed its revised design would not only meet, but exceed RFP requirements on certain missions, the SSSB, using only three dimensional drawings of the new design, determined that the new design might fail one particular landing requirement. The SAF was again briefed by the SSSB on 13 and 18 September. The new cost proposals for 58 airframes (5 for RDT & E and 53 in the initial production run, the first increment of the contract) showed Contractor A's target price of $1,611 million to be equal to Contractor B's ceiling price. The SSSB still recommended Contractor A's proposal, saying that Contractor B's modifications of 4 September would add additional schedule risks and the possibility of increased costs associated with the incorporation of these changes at this time.

As Source Selection Authority, the SAF had advice from other sources. He established a special review group of approximately 20 senior officers. This group attributed only minor risk to Contractor B's new proposal and recommended it be chosen because of the lower price. The

Commander of AFSC concurred with the technical and operational findings of the SSSB; however, he did not consider the design risk critical for Contractor B. Therefore, he recommended Contractor B because of cost considerations. The Commander of MATS recommended Contractor B based primarily on cost. The Commander of AFLC recommended Contractor A on the grounds that its technical and operational design superiority more than offset the attractive price offered by Contractor B. The Air Council recommended Contractor B by a three-fourths majority. The USAF Chief of Staff also recommended Contractor B based on a substantial savings to the Government.

The SAF quoted all of these recommendations in his 21 September memorandum to the Secretary of Defense. (Secretary McNamara had finalized his alternative B decision on 13 September reflecting a six squadron CX-HLS force.) The SAF had concluded that the selection of Contractor B's proposal was in the best interest of the Government.

The final decision. On 30 September 1965, the Department of Defense announced that Contractor B was the winning contractor for the CX-HLS airframe. Contractor B no longer had to worry about its plant being closed due to a lack of business. Since the contract for the CX-HLS had been awarded two months behind schedule, some schedule changes in the contract would need to be made. Or would they?

Questions for Students

1. Identify the key political, economic, technical, and social environmental factors in the case. What effect, if any, did they have on the acquisition of the CX-HLS?

2. Identify the key time-cost-performance tradeoffs that were made. What control did the SPO have over changes to these parameters?

3. "The Total Package Procurement concept dictated that Contractor B be awarded the contract because they submitted the lowest bid." Discuss. In your discussion, indicate whether TPP was appropriate for the CX-HLS program and justify your position.

Glossary

Advanced Development Objective (ADO): The document which describes the general characteristics of an effort designed to fulfill an anticipated operational requirement beyond present technical capabilities.

Buy-in Bidding: Intentional low bidding to win a contract with the expectation that follow-on contracts and other applications will prove to be profitable.

Ceiling Price: The total dollar amount for which the Government is liable under a FPIF contract. For the CX-HLS contracts, the ceiling prices were 130 percent of the target costs.

Concept Formulation Phase: The first phase of a system's development during which its feasibility is determined.

Contract Definition Phase (CDP): The phase during which preliminary design and engineering are verified or accomplished, and firm contract and management planning are performed.

Cost: The expenses incurred by the contractor to accomplish a program.

Fixed-Price-Incentive-Fee: This type of contract has, negotiated at the outset, a target cost, a target profit, a price ceiling, and a sharing formula for establishing final profit and price according to the contractor's cost performance.

Initial Operational Capability: The delivery of the sixteenth operational aircraft to the Military Air Transport Service.

Parametric Studies: Extensive feasibility studies performed by contractors under direction of AFSC.

Phase 1A: The first phase of contract definition when the RFP is prepared and the competing contractors are selected.

Phase 1B: The second phase of contract definition when contractors prepare their proposals.

Phase 1C: The third phase of contract definition when the contract proposals are evaluated and a contractor is selected for development and production of the system.

Preliminary Technical Development Plan (PTDP): The first derivative of concept formulation which specified the system necessary to accomplish the specific operational requirements. It also includes the first cost estimate for the entire program.

Price: The amount the Government pays for a system. For an FPIF contract it is the target price adjusted for any underruns or overruns up to a negotiated ceiling price.

Program Definition Phase (PDP): The same as contract definition phase.

Qualitative Operational Requirement (QOR): A document sent from Hq USAF to an operational command requesting that command to specify desired capabilities of a proposed system.

Request for Proposal (RFP): The notification sent to a contractor informing him of a prospective system for which he is entitled to make a proposal.

Requirements Baseline: The initial approved or conditionally approved product configuration identification.

Source Selection Evaluation Group (SSEG): The group of experts from different functional areas who evaluate proposals submitted by the contractors for the CX-HLS contracts.

<u>Specific Operational Requirement (SOR)</u>: A document sent from Hq USAF to AFSC stating the performance specifications of a proposed system.

<u>System Program Office (SPO)</u>: The SPO is an office within AFSC which ideally acts as a single interface point between the Government and the contractor building the system.

<u>System Source Selection Board (SSSB)</u>: A board made up of four Air Force generals who represented AFSC, AFLC, and MATS. They reviewed the findings of the SSEG and presented their conclusions to the Secretary of the Air Force and other high level decision makers.

<u>Target Cost</u>: The contract cost which is negotiated by the contractor and the Government to establish a baseline for measurement of program cost performance.

<u>Target Price</u>: The target cost plus the target profit.

<u>Target Profit</u>: The fee to be paid to a contractor if actual costs equal target costs. It is usually a percentage of target costs.

<u>Technical Development Plan</u>: A grouping of resources, schedules, costs, and research and development required to fulfill the requirement expressed in an ADO.

INSTRUCTOR GUIDANCE

Possible Answers to Questions

1. Identify the key political, economic, technical, and social environmental factors in the case. What effect, if any, did they have on the acquisition of the CX-HLS?

Answer. Political and economic factors seem to have had an effect on the selection of the winning contractor. After the initial evaluation by the SSSB, the contractors were allowed to make new proposals which were to be evaluated in an extremely short period of time seemingly negating the work of four months to evaluate the original proposals. This favored Contractor B, in effect allowing him to meet the RFP specifications. There is an indication that cost was the dominating factor and that Contractor B needed the contract to keep its plant in operation. With the pressures of the "Great Society" and the requirements of the Vietnam War, there was probably additional pressure to select the low cost contractor.

2. Identify the key time-cost-performance trade-offs that were made. What control did the SPO have over changes to these parameters.

Answer. Time was the critical parameter up until the actual award of the contract. The largest performance trade-off was in the unrefueled range reduction to somewhere

near 5,000 nm. The compressed schedule also resulted in increased R & D costs and additional costs to keep the third contractor in the competition through contract definition. At the time when the contract was actually awarded, cost became the dominating parameter. The changes made by Contractor B presented some amount of risk to the scheduled IOC (the SSSB attributed more risk than the advisory group), but this was traded off in favor of the low bid.

The SPO really had very little control over the changes made in the program. The only success it appeared to have is when their PERT network showed the impossibility of completing the contract definition phase by 1 August 1965. This did not affect the IOC date, however, which would make the winning contractor start off a minimum of two months behind schedule.

3. "The Total Package Procurement concept dictated that Contractor B be awarded the contract because they submitted the lowest bid." Discuss. In your discussion, indicate whether TPP was appropriate for the CX-HLS program, and justify your position.

Answer. The TPP concept would not seem to dictate that the lowest bidder should get the contract. It actually seems to indicate that the contractor with the best combination of performance, schedule, and cost should be selected. In this case, the SSSB was weighing all of these factors and their recommendation fit the requirements of the TPP concept.

Total Package Procurement should probably not have been used in the case of the CX-HLS. The concept probably required changes be made in the existing regulations, multi-year funding for example. The TPP concept would require Congress to release some of its control over the purse strings which seems doubtful under practically any procurement situation. Total Package Procurement would seem to dictate a considerable amount of time be devoted to contract definition; this is the area where the most time was cut to meet the 1969 IOC date. Therefore, both the schedule compression and the lack of directives on how to implement TPP would indicate that it was inappropriate for the CX-HLS program.

Additional Comments

The CX-HLS case is actually a history of the C-5 acquisition. If the case is discussed in class, some comparisons could be made between the environmental factors that existed then and those of the present. A discussion of TPP might also touch on its objectives; the objective then and now is to get a weapon system at lowest life cycle cost. There is still an effort to place some performance guarantees into the contract so that the contractor can be held accountable if the system does not perform for the required number of hours. The discussion of TPP could also lead into a discussion of the appropriateness of fixed price type contracts extending over a long time period. While the

case describes a situation over a decade ago, it still has relevance to today's acquisition environment.

Recommended Reading

Poncar, Jerry V., and James R. Johnston, II. History and Analysis of the C-5A Program: An Application of the Total Package Procurement Concept, AFIT, 1970 (unpublished thesis).

APPENDIX E

SUPPORT PLANNING

APPENDIX E

TABLE OF CONTENTS

THE H-3 HELICOPTER ACQUISITION

INTRODUCTION

Given the complexities of modern weapon systems, it is imperative that adequate and timely logistics support planning be taken in all phases of the weapon system acquisition life cycle. The test of a weapon system's effectiveness is its ability to perform its designated mission. Availability of the weapon system is, however, directly related to its reliability and maintainability and to the effectiveness of its support system in the operational environment.

The Integrated Logistics Support (ILS) Program within the Department of Defense is an attempt to recognize logistical considerations early in the acquisition life cycle of a weapon system, i.e. during the design of the system itself. AFSC Pamphlet 800-3 indicates that

> . . . ILS has been described as a process that identifies the organic Air Force functions required to support operation and maintenance in a timely, systematic and orderly manner. The process requires continual analysis of design to determine logistics impact and to select those that minimize logistics support burdens on the operating and supporting commands, and to make certain that logistics support is available at the operating location upon delivery of the system or equipment for use.

Two levels of planning are often used within an ILS Program:

1. First is the ILS Plan prepared by the Program Management Office with Air Training Command, Air Force Logistics Command, the operating command and other affected organizations. This plan sets forth the ILS objectives and training, maintenance, and operational responsibilities for a particular weapon system.

2. Second, a requirement may be included in the Request for Proposal for the contractor to conduct a logistics support analysis.

Surely, then, ILS embodies a major effort to put support planning into perspective. Perhaps its possible shortcoming lies in its advisory nature. An ILS Program is only as good as the Program Manager or System Program Director allows it to be. All too often decisions affecting system supportability and maintainability are still made without consideration of logistical impacts and out-year costs. This is particularly true when the weapon system acquisition is time constrained.

"The H-3 Helicopter Acquisition" case is presented because it highlights many factors which can impact support planning to the degradation of initial provisioning for the system. The case reflects the "back seat" status of logistics and support planning when emphasis is on the rapid acquisition of a weapon system. It also exemplifies the consequences of neglecting the logistical requirements when fielding the system. Specific points illustrated by the

case are addressed in more detail under the section "Instructor Guidance."

SUGGESTED CLASS PROCEDURE

1. Distribute a copy of the case to each member of the class prior to the planned discussion period.

2. During the discussion period, divide the class into groups of 4 to 6 members each.

3. Allow each group 15 minutes to determine a list of factors that affected support planning in the case and to posit alternatives that, if adopted, might have enhanced the H-3 support planning effort.

4. Have each team brief its case analysis to the class. Discuss the posited alternatives.

Estimated student preparation time: 50 minutes prior to the discussion period.

Estimated class time required (group session and team briefings): 50 minutes.

THE H-3 HELICOPTER ACQUISITION[1]

Overview

The first contract for purchase of CH-3 helicopters by the Air Force was awarded on 8 February 1963. Actual deliveries for operational use began in December 1963. The CH-3C was originally procured as a cargo aircraft for Air Defense Command (ADC) mission support purposes. No tactical use was foreseen at the time of the original contract award. Original specifications called for the H-3 to carry 5,000 pounds of internal cargo for a distance of 200 miles, or 2,400 pounds for a distance of 700 miles. Cruising speed was to be 126 nautical miles per hour.

Since its first acceptance by the Air Force, numerous mission changes resulted in a large number of modifications to the basic aircraft. The primary uses became combat crew recovery and psychological warfare in Southeast Asia (SEA). This change in primary mission resulted in numerous aircraft configuration changes, including the installation of an external cargo hoist, a forest-penetrating rescue

[1]This case is based on a thesis prepared by Captain Edward Baergen, USAF, and Captain John A. Seebacher, USAF, in partial fulfillment of the requirements for a Master of Science degree in Logistics Management at the Air Force Institute of Technology. The authors are responsible for the theoretical development, the conversion of the material in the case format, and the classroom support suggestions.

seat, armor plating, an increased avionics package capability, the addition of self-sealing fuel tanks, and an aerial refueling capability.

The initial System Program Directive called for a proposed purchase of 102 CH-3C helicopters. This quantity, however, was to be funded on a piecemeal basis and spread over a period of six years. In 1964, the austerity budget within the Department of Defense (DOD) caused the total program to be cut back to only 50 aircraft. Approximately four months later, the program was changed to a 74 aircraft procurement. Later, the total program was changed to a 133 aircraft buy, with funding appropriated in small increments extending from fiscal year (FY) 1962 to FY 1969. Plans were announced in September 1965 by Headquarters United States Air Force (USAF) to deploy the aircraft to the Pacific Air Command (PACAF) for use within SEA. Deployment actually began three months later. Aircraft production was accelerated on two occasions to meet the SEA requirements but the production of spares was not.

One deployment to SEA consisted of 14 CH-3C aircraft from two Continental United States (CONUS) bases and from Sikorsky Aircraft Corporation. Six were taken from the Tactical Air Command (TAC), two from the Aerospace Defense Command (ADC), and the remaining six were new production aircraft. These were all originally scheduled to deploy to one SEA location, but at the time of deployment this was changed to four operating bases within SEA. This caused

the original support equipment to be divided four ways and forced the first helicopter units to operate with the barest minimum of spares and aerospace ground equipment (AGE).

The 14 aircraft were originally assigned to the Tactical Air Command and were to be physically located at Tan Son Nhut AB, RVN; Nha Trang AB, RVN; DaNang AB, RVN; and Cam Rahn Bay AB, RVN. These aircraft, however, were placed under the immediate control of the 20th Helicopter Squadron of the 14th Air Commando Wing (7th Air Force) upon their arrival in SEA.

The dispersal problem was further complicated by another deployment of six HH-3C aircraft to an additional SEA location. These six additional aircraft were assigned to the Military Airlift Command (MAC) and were physically located at Udorn, Thailand. The aircraft were under the immediate control of the 38th Air Rescue and Recovery Service (ARRS) Squadron of the 3rd ARRS Group.

By 1966, six Major Commands were using the H-3 aircraft at 15 airbases for their own particular mission requirements. Involved were four major configurations of the H-3, designated the CH-3C, HH-3C, HH-3E, and CH-3E.

Aircraft Description

The CH-3C is a single rotor, twin turbine powered helicopter with amphibious capabilities. The cargo compartment is capable of carrying 25 fully equipped troops, or 15 litter patients with two attendants. The cargo compartment is also equipped with tie-down rings and skids for

transporting cargo. An electric winch, with a capacity of 2,000 pounds, may be used for loading through the ramp or in conjunction with a 600 pound capacity rescue hoist.

Source Selection

In February 1962, Headquarters USAF requested that an evaluation be made of off-the-shelf in-production helicopters which could perform the mission defined in the Specific Operational Requirement (SOR) 190, dated 11 September 1961, with minimum modification. It was known as the HX-2 System Source Selection. Two proposals involving the Boeing-Vertol V-107-II (CH-46) helicopter and the Sikorsky S-61 (CH-3B/C) helicopter were evaluated in April 1962 to determine the most appropriate source to fulfill this requirement.

The source selection process resulted in Headquarters USAF directing the procurement of the Boeing-Vertol V-107-II (CH-46). Three months later the program was redirected to procure the Sikorsky S-61 (CH-3B/C) aircraft for FY 1962 and 1963.

The change in prime contractors was caused by management deficiencies within Vertol which could not be resolved in time to meet the Air Force's desired delivery schedule. This change in contractors negated much of the planning and learning that had occurred up to the point of contractor change. Air Force personnel involved with the helicopter acquisition had become familiar with the system characteristics and the contractor's personnel and techniques.

During and after the original source selection, various preliminary planning actions had been taken to reduce administrative lead time. For example, Vertol and Air Force meetings were held to determine final configuration for the SOR-190 helicopter. Preliminary planning for procurement of Government Furnished Aerospace Equipment (GFAE) had been accomplished up to a point just prior to the release of funds.

There was a high degree of urgency on the requirement for operational helicopters. This urgency was reflected by the Air Force procurement of six Navy-type SH-3A production helicopters to meet an immediate Air Force ADC "Texas Tower" resupply requirement. The Texas Towers were early warning radar sites located beyond the CONUS coast line. Access to these sites could only be gained by boat or helicopter. The six helicopters were designed and configured to Navy specifications with a high percentage of Navy peculiar items. Headquarters Air Force Logistics Command (AFLC) policy was that the Air Force would not provision or stock SH-3A (redesignated CH-3B) spares and repair parts. Navy publications were used to operate, maintain, and support these aircraft. The first CH-3B's became operational to support the Texas Towers in October 1962. The CH-3B required much of the time and personnel resources of the System Program Office (SPO) and System Manager (SM), and necessarily detracted from the major effort of CH-3C acquisition and support planning.

Extremely tight schedules and milestones were levied by Lieutenant General T. P. Garrity (Headquarters USAF Deputy Chief of Staff for Systems and Logistics) and endorsed by General B. A. Shriever. The proposal for SOR 190 was submitted to the SPO in October 1962; a detailed specification and the contract for six CH-3C's in SOR 190 configuration were scheduled for 1 December 1962; and, delivery of the first aircraft was required only seven months later. The first three CH-3C aircraft were used for system and subsystem development, testing, and evaluation. The first operational aircraft were delivered to Tyndall AFB in December 1963, just fifteen months after the final source selection decision.

A second source selection evaluation was conducted in June 1963 and resulted in a follow-on procurement of CH-3C aircraft in FY 1964 and subsequent years. The required monthly delivery schedule provided for only one or two aircraft per month.

The H-3 Acquisition Program

The H-3 acquisition program was characterized by frequent quantity fluctuations and incremental procurements. A total of 41 aircraft were planned for procurement during the first source selection. Program source redirection resulted in the actual contracting of 22 H-3's for FY 62/63. After the second source selection, the programmed quantity increased to 102. The proposed funding schedule, as of July 1963, was:

	FY 62/63	FY 64	FY 65	FY 66	FY 67	FY 68	TOTAL
Quantity H-3's	22	17	9	18	18	18	102

A long range program was provided which allowed visibility for initial and long range logistics planning. One year later, in May 1964, the total program authorized changed slightly as indicated below:

	FY 62/63	FY 64	FY 65	FY 66	FY 67	FY 68	FY 69	TOTAL
Quantity H-3's	22	17	11	9	17	16	15	107

Thus far the H-3 acquisition and support planning process was a relatively normal program. In fact, a glance at the program as of August 1968 shows:

	FY 62/63	FY 64	FY 65	FY 66	FY 67	FY 68	FY 69	TOTAL
Quantity H-3's	22	17	35	19	24	1	15	133

A more detailed analysis, however, as given in Table E.1, reveals a fluctuating acquisition. The total program remained constant until December 1964. At that time, severe budgetary pressure resulted in the cancellation of the FY 66 and subsequent program years. All system support procurement planning was curtailed to the 50 aircraft program. Specifically, this resulted in cancelling the GFAE contract quantities allocated to the H-3. In addition,

advance procurement planning for the major dynamic components, i.e. transmissions, rotors, and rotor blades, was discontinued.

Table E.1

SUMMARY OF CHANGES IN H-3 TOTAL PROGRAMMED ACQUISITION BY AFFECTED QUARTER

Fiscal Year	Quarter	Programmed Quantity
62	3	41
63	1	22
64	1	102
64	4	107
65	2	50
65	4	74
66	2	93
67	2	117
68	3	118
68	4	133

In April 1965, an Interim Program Directive was issued authorizing an increase of the FY 65 procurement from 11 to 35 aircraft with production deliveries to begin in July 1966 at the rate of two per month. During this same time period, Headquarters USAF directed that six of the FY 64 CH-3C's be modified to the HH-3C configuration and subsequently deployed to SEA. The contractor's production facilities approached full capacity. The severity of the situation increased when Headquarters USAF authorized higher priorities and accelerated production of five standard CH-3C helicopters in September 1965. These

accelerated production aircraft were to be delivered by the end of the year and were programmed to support PROJECT PONY EXPRESS[2].

Another acceleration of production and changes in allocation occurred in October 1965. This time, the total FY 65 program of the original 11 and the add-on 24 aircraft was accelerated. Table E.2 shows the quarterly comparison of the original and the accelerated delivery schedule of the 35 FY 65 aircraft.

Table E.2

H-3 FISCAL YEAR 1965 PROGRAM ORIGINAL VS. ACCELERATED PRODUCTION SCHEDULE

	FY 66 Quarter			FY 67 Quarter			
Delivery Schedule	2	3	4	1	2	3	4
Original	4	6	3	6	6	6	4
Accelerated	9	6	6	6	6	2	0

DOD also directed that Government Furnished Aerospace Equipment (GFAE) allocation for the H-3 be accelerated. The contractor was given authority to procure certain installed GFAE items on the aircraft as Contractor Furnished

[2]PROJECT PONY EXPRESS involved 14 CH-3C's assigned to TAC in SEA in late 1965 to provide vertical airlift to initially locate, resupply, and relocate counterinsurgency forces as necessary to accomplish their mission. The aircraft flew civic action commando missions such as airlifting medical teams to villages, hauling rice, and evacuating refugees.

Equipment (CFE) when USAF could not furnish them in time to meet the accelerated schedule. Yet, accelerated spares provisioning to assure concurrent delivery with the early aircraft deliveries was not mentioned.

In late 1965, the helicopter system support management (SM) transferred from Olmsted AFB, Pennsylvania to Robins AFB, Georgia. When this move was made, approximately 90 percent of the functional support management personnel did not transfer with the function. The vacancies were filled with individuals inexperienced in rotary-wing support. In the case of the H-3, new personnel with only fixed-wing support experience were required to make critical decisions on a system with entirely different characteristics than that to which they had been accustomed.

Mission/Configuration Changes

Due to the requirements imposed by special projects and changed missions (see Attachment 1 for examples of various employments/deployments for the H-3), the basic CH-3C was forced to go through many modifications. For example, changes made to the standard CH-3C configuration, as outlined in the revised Detail Specification for USAF Long Range Helicopter (15 June 1964) to be effective with the FY 66 aircraft production deliveries, were:

1. Engines (2): T58-GE-5 to replace the T58-GE-1.

2. Modified (11' diameter) tail rotor subject to ASD recommendation after study.

3. Cargo sling. The minimum capacity will be 6,000 pounds and will provide a load equalizing mechanism including a draw bar indicating system which will show the pilot the pull force in pounds during two operations.

4. Flood lights, externally mounted above the water line, controllable from the cockpit.

5. Fuel system will include self-sealing main fuel tanks, externally mounted auxiliary fuel tanks which are releasable in flight by the pilot, and the provisions for internal auxiliary fuel tanks now provided will be maintained. A fuel jettison system will be provided.

6. Armor will be installed for the protection of crew and vital aircraft components. Armor will be removable when not required.

7. Shatterproof windshield and cockpit transparencies will be provided. The windshield will be provided with anti-icing, windshield washer and wiper provisions.

8. A cruise guide blade stall indicating system will be provided.

9. Avionics package will be changed to include installation of the following additional equipments:

a. AN/ARC-54 FM Radio.
b. HF-103 SSB Radio.
c. VHF-101 AM Radio.
d. AN/APN 130 Doppler Navigation System
e. AN/APX 64 Transponder
f. LORAN C.
g. VHF FM radio homing adapter.
h. AM 3969 pre-amplifier for UHF homing adapter.

10. Engine inlet ice deflection shield to be provided.

11. Provisions for the installation of the following:

a. Hard point provisions for non-amphibious landing gear installation after removal of sponson.

b. Hard point plumbing provisions for probe in-flight refueling system.

c. Externally mounted loud hailer.

d. Externally mounted variable speed rescue hoist.

e. Inert victim/survivor rescue platform for use in recovery from surface of water.

f. Infra-red radiation suppression system.

In addition to these changes, the special projects listed at Attachment 1 often stipulated their own unique modifications. For example, the aircraft to be supplied to the Aerospace Rescue and Recovery Service (PROJECT LONG ROPE) were designated HH-3H and required the following additional equipment:

1. Complete air refueling system.
2. Loud hailer.
3. External variable speed rescue hoist with "forest penetrator" seat attached to 250 foot length of cable stressed for loads of 600 pounds.
4. Rescue platform.

Other special projects required such modifications as defensive armament installations, camouflage paint, structural modifications to the loading ramp, and sand-separator engine inlets.

So many changes were made to the basic CH-3C in converting it to the HH-3E that, in order to provide support for the modified items, a spare parts provisioning conference had to be held in January 1966. Additionally, unprogrammed parts requirements under a combat environment resulted in the H-3 aircraft requiring reprovisioning only ten months later, in October 1966.

Normally, if modifications were not extensive, provisioning could be accomplished by a "desk provisioning" between the aircraft technician and the item manager using

provisioning documentation from the contractor. However, the modifications on the H-3 were so extensive that provisioning required the attendance of the aircraft System Manager, his provisioning team, the contractor, individuals from the using command, and item managers from other than the prime Air Material Area who were associated with the HH-3 support.

Test and Evaluation

The flight test program was based on a limited number of aircraft and flight hours authorized for test. In planning the test program, the primary objective seemed to be the urgency of attaining early operational readiness. In normal weapon system acquisition programs the first few production aircraft are programmed for Air Force Categories I and II testing.[3] However, since the CH-3C was procured as a Federal Aviation Administration (FAA) certified aircraft, there was no formal Category I test program. An agreement consummated between the Air Force, Navy, and the FAA stated

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[3]Definitions of Categories I, II, and III are:

Category I: Subsystem Development, Test and Evaluation--consists of development testing by the contractor of new or redesigned components and subsystems of the weapon system.

Category II: System Development, Test and Evaluation--consists of adverse weather operation and the expansion of the flight envelope for handbook data.

Category III: System Operational Test and Evaluation--consists of using command tests and evaluation of operationally configured systems with all components, support items, and personnel skills under operational conditions.

that a Type Certification program would be accomplished in lieu of formal Category test.

No testing was done on subsystems that were identical to those already tested and accepted by the Navy or FAA. Other testing was planned and conducted to demonstrate compliance with the Detail Specification and to expand the flight envelope beyond that of FAA Type Certification which was limited to gross weights up to 19,500 pounds. The characteristics of the complete test program, an extremely tight schedule, and non-availability of aircraft during this period resulted in a limited Air Force flight evaluation of six hours before acceptance of the first operational aircraft.

After deployment, structural cracks appeared at the main gear box attaching points indicating that the fuselage rib structure was not capable of sustaining in-flight loads to which the helicopters were being operationally subjected. By 31 May 1965, 15 aircraft reported such structural failures. This resulted in excessive aircraft downtime because of the time required to build and ship repair kits.

Southeast Asia Deployment

The deployment of H-3 helicopters to SEA began when, on 3 July 1965, two CH-3C aircraft on loan from TAC arrived in SEA for use by ARRS crews. This deployment was made under a SECRET classification. No advance notice was given to the H-3 SM in order to provide advance logistics support for these aircraft. The SM was unaware of the move until he

was notified by a classified message several days after the deployment. In September 1965, an information message, CSAF AFXDC 92406, from Headquarters USAF alerted the SPO and SM for a new project, PROJECT PONY EXPRESS (see Attachment 1), and requested them to plan for the deployment of 25 H-3's to one SEA location, pending OSD (Office of the Secretary of Defense) approval. The proposed deployment schedule was: September--15 aircraft; October--3 aircraft; November--4 aircraft; and, December--3 aircraft. Fourteen of the proposed aircraft were to come from the active inventory and 11 from new production. Headquarters TAC was to be responsible for the movement of the operational aircraft, aircrews, support personnel, and support equipment. These 25 aircraft were to include the two operational CH-3C's already in SEA.

It was not, however, until the H-3 Material Support Conference held at WRAMA with TAC, AFLC, AFSC, ADC, and contractor personnel that the total number of aircraft to be deployed was set at 14. At this time, plans were developed to provide support for one main base and two operating bases within SEA and AGE was allotted for these locations. Three sets of mobility spares and AGE kits were to be a part of the initial deployment. Separate Initial Spares Support Lists (ISSL's) were authorized for: (1) airframe, (2) engines, and (3) communications and electronic items. Follow-on support procedures were to be those established by PACAF using the Speed Through Air Resupply concept.

The TAC aircraft actually began their deployment 1 December 1965 after receiving a movement order for eight CH-3C's. At this time the required ISSL's were about 90 percent filled, mobility kits were 93 percent filled, while the AGE requirements were 97.6 percent filled for one main base. However, this high priority deployment seriously depleted depot stocks and other support assets. By 5 December, these aircraft were in place at Tan Son Nhut AB, RVN. Ten days later, two additional aircraft were sent from Sikorsky to Tan Son Nhut AB for a total of ten. By January 1966, these aircraft had already been dispersed to DaNang AB, RVN and Cam Ranh Bay AB, RVN, making three main bases, plus additional operating bases.

The last two CH-3C's of the 14 programmed left for SEA 11 January 1966 to complete the initial deployment. An additional six CH-3C's modified to HH-3C's were deployed to Udorn, Thailand for ARRS operational use. One additional set of initial spares and an additional set of AGE were sent to Udorn to support these aircraft. These six aircraft began deploying during November 1965. It was also during this month that one of the original CH-3C's, sent to ARRS in June, was shot down by enemy fire.

Starting in December 1965, the Air Force began accepting aircraft without certain GFAE components such as: (1) fuel flow indicators, and (2) bearing-distance-heading indicators. This was caused by lead times involved in

acquiring the GFAE and the accelerated delivery schedule on aircraft demanded by the Air Force.

Additional CH-3C's and HH-3E's were sent to SEA during 1966. These were replacement/attrition aircraft and others that were added to PROJECT LONG ROPE in order to expand its scope of operation. For example, by 1 March 1967, there were 25 aircraft operating from four forward operating bases. By September 1967, this had increased to 35 aircraft operating from five main bases in SEA, each main base requiring its own set of AGE and spares.

Determine the factors that prevented adequate initial logistics planning and support of the H-3 helicopter. Suggest alternatives that might have improved the logistics planning and support effort.

List of Abbreviations

ADC--Air Defense Command
AFLC--Air Force Logistics Command
AGE--Aerospace Ground Equipment
APCS--Air Photographic and Charting Service
ARRS--Air Rescue and Recovery Service
CFE--Contractor Furnished Equipment
CONUS--Continental United States
FAA--Federal Aviation Agency
GFAE--Government Furnished Aerospace Equipment
ISSL--Initial Spares and Support List
MAC--Military Airlift Command
PACAF--Pacific Air Command
PR--Purchase Request
RVN--Republic of Vietnam
SAC--Strategic Air Command
SEA--Southeast Asia
SM--Support Manager
SOR--Specific Operational Requirement
TAC--Tactical Air Command
WRAMA--Warner Robins Air Material Area

OPERATIONAL EMPLOYMENT AND DEPLOYMENT

Mission changes and the resulting configuration changes of the H-3 impacted on support planning in various ways. The mission changes resulted from H-3 participation in various high priority projects. Examples of these projects are:

1. BUCKEY BIRD: This project involved three CH-3C's which were sent to Germany in May 1964 for evaluation by the German government. These aircraft were of the standard configuration but required all personnel and support to be furnished USAF, including spares, AGE, and technical manuals. The project involved 60 days of testing. Two of these aircraft were later assigned to PROJECT KINGS RANSOM.

2. KINGS RANSOM: Headquarters USAF programmed three CH-3C's for use by the Air Photographic and Charting Service (APCS) beginning operation in April 1964. Higher priority projects caused diversion of these aircraft to other projects. Two CH-3B's were then programmed for July 1964, but were later slipped to September 1964. Then in September, USAF withdrew these CH-3B's and authorized two CH-3C's from AFSC PROJECT BUCKEY BIRD to be used on this project. These aircraft were finally delivered to APCS

in Ethiopia in November 1964. This was the first overseas assignment of the CH-3C.

3. SOUTH SHORES/GOLDFIRE I: In February 1964, Headquarters USAF authorized 12 CH-3C's for assignment to TAC instead of the originally intended commands. These aircraft were utilized in support of a joint Army-Air Force mobility exercise. This was the first operational exercise for the CH-3C. All these helicopters were airlifted into the exercise area on a simulated overseas deployment, reassembled, and placed into operation under bare strip conditions. Unprogrammed requirements and lack of firm information of TAC's utilization of this weapon system caused a profound impact of CH-3C support and affected the overall program.

4. NASA GEMINI/MOL SUPPORT: This project involved four CH-3C helicopters which were used in support of aerospace recovery operations. The missions involved extensive over-water operations posing corrosion control problems and the installation of long-range fuel tanks to increase endurance from the normal four and one half hours to seven hours.

5. OUTPOST: Involved three CH-3C's, operating from Olmsted AFB, Pennsylvania, on a special classified mission.

6. BIG SAFARI/LIGHTNING BUG: This was a SAC project that initially (1965) required three CH-3C's with a

unique configuration that included aerial retrieval gear to perform a classified mission.

7. LONG ROPE: Six new, combat rescue equipped HH-3E helicopters deployed to SEA and formed the nucleus of this project in 1965. The aircraft were under the operational control of the Air Rescue Service. The primary objective was the retrieval of combat crew members up to 200 miles inside hostile territory in areas where the jungle canopy reached a height of 180 to 200 feet above the ground.

8. PONY EXPRESS: This project involved 14 CH-3C's assigned to TAC in SEA in late 1965 to provide vertical airlift to initially locate, resupply, and relocate counterinsurgency forces as necessary to accomplish their mission. The aircraft flew civic action commando missions such as airlifting medical teams to villages, hauling rice, and evacuating refugees.

9. SEA KNIGHT: This was a project to modify a classified number of existing aircraft, both CH-3E's and HH-3's, for night operations.

10. MUSCLE SHOALS: This was a high priority, classified SEA project requiring unique modifications because of many additional requirements placed on the aircraft.

INSTRUCTOR GUIDANCE

The case is but a brief summary of a seven year time period and addresses events that ultimately impacted the employment and deployment of the H-3 series of helicopters. A number of areas highlighted by the case that affected support planning are discussed below.

Incremental Acquisition

As noted in the case, programmed procurement fluctuated drastically from source selection until deployment to SEA. Such program instability was extremely disruptive to support planning. The fluctuating acquisition, cancellation, and reinstatement of the H-3 was characterized by uncertainty and at times provided little or no justification for procurement of spares and AGE by logistics personnel. This lack of advance programming information is evidenced by an internal AFLC letter dated 11 January 1965, Subject: CH-3C Program Change.

> Two messages have been received from CSAF (Chief of Staff, Air Force) cancelling the CH-3C Helicopter programs for FY66, FY67, FY68, and FY69. A total of 57 aircraft are involved. No information was furnished as to why the programs were being cancelled and there is no indication of possible reinstatement at some future date.

According to Federal Government fiscal practices, funds are appropriated on an annual basis. Consequently,

most contractual funding also takes place annually. Most large weapon system acquisition programs are relatively immune from drastic budget cuts and cancellations insofar as design and development costs have been incurred and there is a reluctance, both economically and politically, to cancel such programs. The off-the-shelf H-3 was not held in such esteem and was more vulnerable to temporary and permanent budget reductions. Perhaps what is not appreciated is the negative effects that cancellation, reinstatement, and finally acceleration have on acquisition and logistics planning. Even after reinstatement, the H-3 support inventory was programmed in small increments. A long range force structure program did not seem to exist for the H-3. As a result, logistics support planning and support effectiveness was degraded.

Certainly multiple year appropriations would be highly desirable for weapon systems acquisition. Logisticians at all levels would have the visibility to plan and program the acquisition of weapon systems and their associated support. Authorizing such multi-year procurements would be another alternative which would improve logistics support, particularly in the areas of GFAE, spares, and overhaul contracting. More stability would be achieved and limited long range planning would be possible.

Off-the-Shelf Procurement

Off-the-shelf procurement has a connotation of ease of acquisition and support management. Consequently,

managerial emphasis tends to be lacking at various organizational levels.

Two definitions for off-the-shelf procurement are often used:

1. Another service managed and funded the basic design and development and the item can be used "as is."

2. The same development situation as above but with major design changes that rule out parts and components interchangeability.

The CH-3C had been planned to be acquired in accordance with definition 1 above. Yet, the actual aircraft best fits definition 2 above. The Navy SH-3A and Air Force CH-3C/E are actually two entirely different aircraft with virtually no interchangeability of parts. Logistics support for off-the-shelf procurements ought, perhaps, be designated as totally new procurements and given the attention they deserve.

Management Inefficiencies

It appears that logistics personnel were able to react quickly enough to the fluctuating situation that existed with the H-3 acquisition to provide marginal support for the aircraft. However, reactive logistics produces wasted resources (time, money, personnel, material). Advance planning within a reasonable time frame could reduce/eliminate wasted effort. An example of wasted effort and lack of coordination follows.

In 1965, the original production schedule called for delivery of one aircraft in October, two in November, and two in December. The sum of $37,500 was given to Sikorsky to accelerate production to two aircraft in October, four in November, and four in December. The aircraft were produced on schedule and accepted by the government. The contractor fulfilled his obligation. Under normal circumstances, the aircraft should have flown away for operational use within a week after government acceptance. Yet, the fact remains that for the ten aircraft, there were delays averaging 45.8 days per aircraft because of GFAE shortages. The Government managed, and paid, to have the aircraft accelerated; yet it could not furnish the GFAE to make them operational. This same problem existed for aircraft tail numbers 64-14227 through 65-12792, or 37 aircraft. Average delay on these aircraft was over 40 days. It seems that the alternatives here are to not accelerate production or to guarantee that production on installed equipment is accelerated at the same rate as the end items.

Single Manager Concept

Management occurs throughout the life cycle of a weapon system acquisition, and at any point in time one person has total responsibility to manage the system. When a SPO is established within AFSC, the System Program Director (SPD) becomes the focal point for the total management of his system. Near the end of the acquisition life cycle, the total management responsibility is transitioned to the

System Manager (SM) in AFLC. The system management process is complex, and there may well be a period when both the SPD and SM are functioning at the same time.

It seems as if the objectives of the USAF (i.e. Headquarters USAF), AFSC, and AFLC are not always in complete accord. Headquarters USAF objectives encompass force structure planning and development of systems to satisfy operational requirements. At the same time, the operational requirements must be met within resource and time constraints. Resource constraints are set by the amount of dollars available for a program. Time is a constraint for operational and logistics personnel for different reasons. From the operational viewpoint the constraint is the time it takes to acquire an aircraft and make it operational. In this respect the helicopter's time constraint was not overly severe. Helicopters are acquired and become operational in much less time than fighter or cargo aircraft. But for the logistician, this is a vexing problem. Usually the more time it takes to develop and acquire a system, the more time there is to plan, acquire, and pre-position logistics support. The H-3 acquisition provides an example of a time-compressed acquisition that severely constrained logistics performance.

AFSC's objective encompasses design, engineering, and development. Trade-off decisions must be made among time, cost, and system performance. Although the SPO does have interest in future support, it is not, practically

speaking, necessarily the SPO's primary concern. A decision to accelerate the acquisition of a weapon system can be detrimental in supporting the system. (In all fairness, it must be noted, as in the case of the H-3, that decisions to accelerate acquisition usually seem to occur external to the SPO. Then both AFSC and AFLC reactively manage to this external decision or "crises.") The SM must provide logistics support which is measured as the support effectiveness of the system after it becomes operational. Providing the using command with a system and adequate logistics support requires effective management; AFSC and AFLC must work together in close coordination. This is particularly true in cases as the H-3 acquisition, where lead times for procuring support items can exceed the weapon system acquisition lead time.

The Air Force single manager concept is not always clear to industry. During the development and acquisition of weapon and support systems, the contractor works with a number of managers within the Air Force. In the case of the H-3, contractor personnel indicated difficulty, at times, in determining which Air Force agency to contact for decision making.

The Air Force management concept for weapon system acquisitions embraces the concept that the SPO is the single point of contact with the contractor. In the case of the H-3 (and the later H-53 program), both Headquarters USAF and Headquarters AFSC weakened the authority and decision

making capacity of the SPO. Because of "urgent" requirements, a number of decisions were made at an organizational level above the SPO. As already noted, this resulted in the SPO reacting to requirements based on decisions the SPO Director should have made.

A number of alternatives exist for improving the coordination between the SPO and AFLC with respect to system support and support planning. Certainly the Integrated Logistics System is an attempt in this direction. Experience has shown, however, that the logistics personnel assigned to the ILS office at a particular SPO are by and large advisors to the SPD. They are not necessarily brought into the decision making process on decisions affecting system supportability. The creation of the Deputy Chief of Staff (DCS) for Acquisition Logistics within Headquarters AFLC is also an attempt to bring the SPO and AFLC closer together.

Other alternatives include making AFSC responsible for development of the weapon system and a system prototype and making AFLC responsible for the acquisition and support of the system. Or, the SPO might be made responsible, through contractor support, for all support requirements for the first two years of operational use. Then the system would be turned over to AFLC for continuing support.

Summary

The foregoing is not an exhaustive listing of the implications of the H-3 case. Certainly the student will

offer many varied opinions and viewpoints with respect to the events that impacted the acquisition and management's reaction to the events. Points that the authors feel important include the effects of the incremental acquisition, the apparent assumption that off-the-shelf procurements are "easy," and the shortcomings of the single manager concept as it materialized with respect to the H-3. Other "deficiencies" illuminated by the case include the lack of programming information needed for support planning (planned flying hours, base dispersal, number of forward operating bases, etc.), the switch in source selection, and the lack of rotary-wing experience within the SM's office as a result of the move from Olmsted AFB to Robins AFB (see Appendix C, case entitled "Air Rescue and Recovery Helicopter"; certainly rotary-wing experience within the SPO would seem desirable).

APPENDIX F

MANAGING PRODUCTION

APPENDIX F

TABLE OF CONTENTS

I. INTRODUCTION

I. INTRODUCTION

As part of the weapon system acquisition process, the Program Manager considers two major categories of equipment for inclusion in the weapon system: contractor-furnished equipment (CFE) and Government-furnished aeronautical equipment (GFAE). The former is an item either manufactured or purchased by the contractor for inclusion in the weapon system; the latter is equipment that the Air Force procures and furnishes to the contractor for inclusion in the weapon system. The purpose of GFAE is to establish a commonality and standardization of equipment among many systems. Use of GFAE also reduces the multitude of different items in the Air Force Logistics Command (AFLC) inventory. Further, economy of scale and specialization in procurement of GFAE items provides increased equipment acquisition efficiency and effectiveness. This frequently enables the Air Force to provide system components to manufacturers at a life cycle cost lower than comparable CFE.

GFAE Management[1]

Basically, GFAE management is a subset function of the weapon system production management. The GFAE management cycle starts upon receipt of the USAF Working Aircraft/ Working Missile (WA/WM) production forecast schedule. This document shows the quantities and schedules of weapons systems for the current and next five year period. GFAE experts from within Aeronautical Systems Division (ASD), working with the weapon system program office, identify the GFAE configuration for each weapon system and develop an initial list of GFAE item requirements which is integrated into the Request for Proposal (RFP) to industry. The contractor evaluates the Air Force GFAE list in the context of his production plans and normally counterproposes a list of GFAE in response to the RFP.

The proposed GFAE list is formalized for the weapon system and identified in the contract after source selection. The contractor then time phases the GFAE requirements and develops a "GFAE Requirement Schedule." This schedule shows the time phased schedule and quantity of GFAE needed for production requirements. Based on the contractor prepared schedule, a supportability study is accomplished by

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[1]The following discussion is an edited version of Lieutenant Ronald B. Starr's "A Case Study of Some GFAE Production Problems Encountered by the F-5 System Program Office" (unpublished master's thesis, School of Engineering, Graduate Systems Management, Air Force Institute of Technology (AU), Wright-Patterson AFB, Ohio, September, 1974).

the Deputy for Subsystems upon request by the System Program Office (SPO). The study confirms the commitment that the Air Force can deliver GFAE items to the weapon system contractor according to the contractor schedule or gives the best alternative schedule the Air Force can support.

Within the Air Force, both Air Force Systems Command (AFSC) and Air Force Logistics Command (AFLC) possess management responsibility for GFAE items. AFLC is normally responsible for older GFAE items transitioned from AFSC which exhibit logistic stability. AFLC uses their established management procedures on those items. Within AFLC, the Air Logistics Center (ALC) is the focal point for securing and providing the GFAE item to the weapon system contractor.

When AFSC is the responsible activity, the management responsibility is centered in the Deputy for Subsystems of the Aeronautical Systems Division. Each GFAE item is managed by an individual project manager. The GFAE project manager is responsible for insuring that properly functioning GFAE items are available to the contractor's production facility to meet the production schedule. (There is also an individual in the production office of each SPO who monitors GFAE for his program.) The principal source of GFAE items is individual equipment procurements initiated by the project manager. The project manager plans and controls his procurement effort from the time of requirements identification through installation of the GFAE item in the weapon system

and acceptance of the aircraft by the using activity. The GFAE management responsibility terminates for the project manager when the GFAE item's engineering and procurement responsibility is formally transitioned to AFLC. Regardless of whether AFSC or AFLC is responsible for the individual GFAE item, the Deputy for Subsystems and the SPO GFAE monitor continue to monitor the GFAE item until the weapon system transitions from ASD to AFLC.

The Flow of GFAE Assets

A representative flow of a GFAE item procured from a GFAE vendor to final installation in a weapon system is shown in Figure F.1. The detailed process of providing a GFAE item to a weapon system contractor starts with the requirement as documented on the contractor's production schedule. There are two sources of GFAE items. The item can come from existing inventories within the government controlled by the Defense Logistics Service Center, AFLC, or similar activities; or the GFAE item can be procured from a GFAE vendor. Formal acceptance by the government of a GFAE item procured from a vendor is accomplished after acceptance testing at the vendor's plant. After this government acceptance of the GFAE item, it is normally packed and shipped to the weapon system contractor. Initial acceptance of a GFAE item by the weapon system contractor is normally accomplished after an incoming bench test. If an item is found good, it is issued to the production line for installation in the weapon system. Typically, the item is ground checked several times

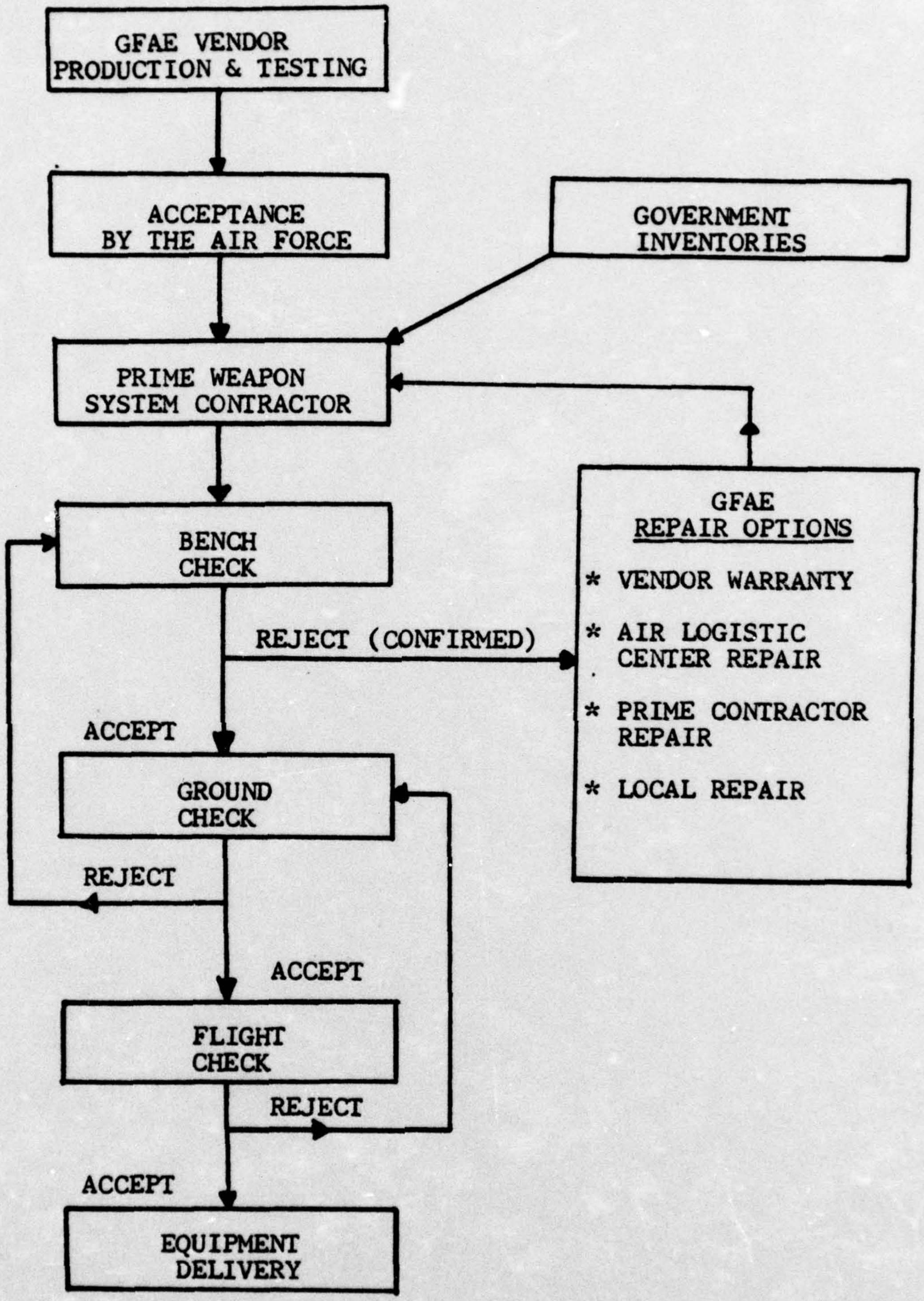

Figure F.1

GFAE EQUIPMENT FLOW

on the line and then flight tested with the weapon system. After these tests, the Air Force accepts the weapon system with its associated GFAE items.

If a GFAE item is found to be defective during any of these testing phases, the defect is confirmed by the Air Force Plant Representative Office (AFPRO). The item is designated a bona fide reject and the GFAE reject reporting procedure is initiated.

By definition, a GFAE reject is a unit that malfunctions or has evidence of damage. This definition excludes any items requiring minor adjustment, calibration, or minor repair which could be accomplished at a production installation station. A unit may be suspect or bona fide reject. A suspect reject is one which has not been verified by government quality assurance personnel. A bona fide reject is a suspect reject that a government quality assurance representative has verified requires repair or replacement.

After the GFAE item is confirmed to be a reject, several options are available for repairing the rejected item. These options include:

(1) Repair by the GFAE vendor under a warranty provision or repair clause in his contract.

(2) Repair by an Air Logistic Center.

(3) Repair by the weapon system contractor.

(4) Local repair under a purchase order from the weapon system contractor.

After repair of the GFAE item, it is returned to the weapon system contractor and again placed in the test, acceptance, and installation cycle.

Problem

The current Air Force GFAE system does not always function effectively. When the system does not function effectively it can adversely impact the production schedule of a prime weapon system contractor.

If GFAE items are not provided to the weapon system contractor in a timely manner or if the items are not of acceptable quality, they may cause production line disruption. These items may have to be installed at a later point in the production line than where they were intended to be installed (commonly called out-of-station installation), which may result in additional cost to the Air Force. Rejects may also add expenses to the contract due to additional GFAE testing, repair, transportation, replacements, and reporting. If the rejection rate of a single GFAE item is severe enough to deplete existing AFLC inventories and/or current new production of that GFAE item, production aircraft may have to be accepted short (less the required GFAE item) or, in the worst case, the aircraft may not be accepted if that GFAE shortage would compromise safety of flight.

GFAE rejects can be a manifestation of any one or more of several deficiencies. These deficiencies include incompatible test procedures between the GFAE vendor and the weapon system contractor, defective or incompatible GFAE

procurement specifications, damage in transportation or installation, or unpublished changes in aircraft design. Regardless of the cause of the GFAE reject, the GFAE managers within the Air Force are responsible to initiate some corrective action, since the defective GFAE item is owned by the Air Force. This corrective action must provide acceptable GFAE items to the prime weapon system contractor in accordance with the production schedule.

The following two cases present some of the problems encountered by GFAE managers. The first case, "The A-20 Accelerometer," presents a situation where the GFAE manager must take immediate action to prevent a possible halt in the A-20 production line. The second case, "The F-25 Central Air Data Computer," presents a similar, though somewhat more complicated, problem. In this case, the GFAE manufacturer is meeting the present production schedule but does not have the capability to increase production to accommodate a projected increase in demand. The problem is further complicated when inspection reports from the prime contractor reveal an apparent quality control problem with the CADC. Here the GFAE manager must make a recommendation as to what action to take. The case can also be used to focus on some of the "hidden" costs involved in GFAE management.

II. THE A-20 ACCELEROMETER

SUGGESTED CLASS PROCEDURE

1. Give each member of the class a copy of the case and divide the class into groups of 4 to 6 members each.

2. Allow each group 20 minutes to determine viable alternatives and a recommended course of action.

3. Reassemble the class and lead a discussion of the alternatives enumerated by the groups and the recommended actions.

Estimated student preparation time: 20 minutes.

Estimated class time required (student preparation and discussion): 50 minutes.

THE A-20 ACCELEROMETER

The A-20 close air support aircraft is unique in its characteristics of high survivability in an extreme surface-to-air threat environment, its GAU-8/A 30 mm Gatling gun, its 16,000 pound mixed ordnance carrying capacity, and its long loiter time. It is also unique in that approximately 48 percent of its system components are provided to the manufacturer by the Government as Government-furnished aeronautical equipment (GFAE). Of course, the driving force behind this relatively large percentage of GFAE is the result of Air Force attempts to reduce system acquisition costs.

The A-20 System Program Office (SPO), Directorate of Manufacturing Operations (YXD) is directly concerned with assuring that GFAE items meet the manufacturer's dock time schedule. (The dock time schedule specifies when components must be in place at the production facility so that the aircraft can be assembled in accordance with the production schedule. The dock time becomes particularly critical when, for example, assembly must be halted until arrival of the needed item: a wing cannot be fabricated, for example, until the wing spar is in place.) YXD manages the contracts for the various items of GFAE.

If an item of GFAE does not meet its scheduled dock time, a number of consequences are possible:

-- production might be halted until the item arrives;

-- production might continue "around" the missing item and the item installed or assembled when it does arrive; or

-- production might continue "around" the missing item and the missing item be installed after the system has been delivered to the Government. In any event, if GFAE dock times are not met, the Government usually incurs a penalty, either in dollars, slipped delivery dates, or both.

On 28 December 1975, Major John Elk, GFAE Manager for the A-20, was just settling back at his desk with his first cup of the morning's coffee when his telephone rang. The end result of a long, somewhat heated and completely disconcerting conversation with the Vice President for Production at the Bakelite Corporation was that Bakelite could not meet its 30 December, not-later-than delivery date for six $3,500 accelerometers to the A-20 manufacturer. A check of the dock time schedule for the accelerometer indicates that all six are to be in place at the manufacturer's production facility on 6 January. A frantic call by Major Elk on the hot line to the manufacturer confirms the dock time schedule is "good" and the aircraft will "roll out" of the production line on 12 January. Major Elk realizes that if the dock time is not met that the aircraft will be delivered to the Air Force without the accelerometer (the alternative is to halt production on the six aircraft, thereby incurring the cost of "clogging" the assembly line with six uncompleted

aircraft). Put yourself in Major Elk's position. What are your alternatives, and which of these would you select in approaching this problem?

INSTRUCTOR GUIDANCE

Assuming that halting the production on six aircraft (and perhaps missing the programmed aircraft delivery date) is undesirable, Major Elk's options are limited. Certainly punitive action can be brought against Bakelite for breach of contract, but this will not meet the dock times for the accelerometers. An advance unfunded purchase request (PR) could be issued and expedited, but this probably would not meet the dock time or the aircraft delivery date either.

Two informal alternatives are available and they depend heavily on Major Elk's knowledge of and personal relations with the Air Force Logistics Command Item Manager for the accelerometer and the other SPO's that use the same accelerometer. This case reflects an actual incident and, in fact, the Item Manager was able to provide four accelerometers and another SPO found two accelerometers; the 6 January dock time was met. An advance unfunded purchase request was issued; funds were made available for the PR and the Item Manager and SPO were "paid back" with six accelerometers. Even in the big league of weapon system acquisition, it pays to maintain good relationships with other managers. A swapping of "favors" can sometimes prevent major problems and possibly decrease overall costs for the Government.

III. THE F-25 CENTRAL AIR DATA COMPUTER

SUGGESTED CLASS PROCEDURE

1. Give each member of the class a copy of the case and divide the class into groups of 4 to 6 members each.

2. Allow each group 20 minutes to read the case and determine a solution to the problem.

3. Reassemble the class and select one group to present their solution to the problem.

4. Have the rest of the class critique the solution and present alternative solutions.

Estimated student preparation time: 20 minutes.

Estimated class time required (student preparation and discussion): 50-75 minutes.

THE F-25 CENTRAL AIR DATA COMPUTER

The F-25 International Fighter Program began to experience production problems as a result of shortages of certain Government-furnished aeronautical equipment (GFAE) items. The initial F-25 contract had included 89 GFAE items, but due to the System Program Office's (SPO) constant review and conversion of contractor-furnished equipment (CFE) to GFAE, the GFAE list now included 132 items used on the various versions of the F-25. Thus, a significant portion of the work in the F-25 SPO Production Office involved monitoring GFAE items. The responsibility for monitoring these items was currently divided among seven individuals where previously it had been a single individual's responsibility. Captain Bright, a new man in the office, had been unfortunate enough to inherit management of a particularly troublesome piece of GFAE, the Central Air Data Computer (CADC).

The CADC was initially a piece of CFE. After production got under way, the SPO determined that significant savings on the F-25 program could be made by converting the CADC from CFE to GFAE. This conversion was completed after the 26th production aircraft; the 27th production aircraft was the first to have the CADC as a GFAE item.

The GFAE contract for the CADC was awarded to Barrett Avionics in June of 1972. The contract specified a delivery

rate of 10 per month. In 1973, orders for more F-25 aircraft were initiated and planned production was increased. With this planned production increase came an increased demand for the CADC. A modification to the Barrett contract raised the delivery rate to 13 per month.

Barrett Avionics was the only qualified source for the CADC and they had limited production capacity. At the time of the original contract, they were more than capable of meeting production requirements. The present modification to the contract, however, was what Barrett considered its upper production limit based upon their present tooling and production techniques. Therefore, any increase in requirements would necessitate some sort of change.

The F-25 had just received more foreign orders for aircraft, increasing production requirements. To support this increase, the delivery rate of the CADC would have to rise to 15 per month by October 1974, and to 20 per month by April 1975. Captain Bright had anticipated the problem and had formulated two alternative solutions that he was going to present to his boss, Colonel Moore, tomorrow morning. One alternative was to qualify another source of production; the second one was to provide Barrett more tooling and test equipment to allow increased production.

Captain Bright thought he had everything figured out when he began looking over the reports on reject/failure data from Thornrup Aviation, the prime contractor for the F-25. The reports indicated that over 30 percent of the

CADC units arriving at Thornrup failed the receiving inspection. It appeared that production capacity was not the only problem Barrett had; they obviously had quality control problems as well. Captain Bright was beginning to wish the SPO had never converted the CADC to GFAE. If it were still CFE, it would be the contractor's problem and not his. However, his immediate problem was tomorrow morning's meeting and what should be done about the CADC. If you were in Bright's shoes, which of the two alternatives would you recommend to the Colonel? Be prepared to justify your recommendation.

INSTRUCTOR GUIDANCE

This case addresses really two problems: what should be done about increasing the production rate of the CADC and why there is such a high rejection of CADC's at Thornrup. If the student assumes that the second question is already answered, i.e. it's a quality control problem at Barrett, then he may recommend that the Air Force qualify a new source for the CADC. However, in the actual situation, the high rejection rate was a result of differing test procedures at Barrett and Thornrup; when these were resolved the rejection rate was reduced to an acceptable level. The production problem was resolved by providing Barrett with more tooling and test equipment to increase their production capabilities.

Qualifying a new source for the CADC could result in benefits to the Government by creating competition, However, the choice should not be made solely on the basis of the apparent poor quality of the Barrett CADC. The student should address the "why" of the high rejection rate before jumping to conclusions. In the actual situation, it appears that the SPO determined that qualifying a new source would require a longer period of time, which could have adverse effects on the aircraft production schedule.

Additional Comments

Additional discussion could address the problem of GFAE administrative costs. In this example, it took seven people to monitor the GFAE program, as well as the generation of a significant number of contractor reports. In computing cost savings of GFAE items, it may be that administrative costs are ignored. The Government may also be incurring the costs of delays in production due to GFAE management problems. If the items were CFE, the contractor would be responsible for production delays but the Government could lose control over the selection and performance of the subcontractors.

APPENDIX G

MANAGING TOTAL SYSTEM INTEGRATION AND ELIMINATING CONTRACT/HARDWARE DEFICIENCIES

APPENDIX G

TABLE OF CONTENTS

I. INTRODUCTION

I. INTRODUCTION

Managing total system integration is the most difficult and pervasive problem in weapon system acquisition management. It is normally associated with managing the technological interfaces of the weapon system. The basic concern here is to insure that all subsystems perform with each other to contribute to total system performance. However, to achieve this integration, there must be effective management of the organizational interfaces between the System Program Office (SPO), the prime contractor, possible associate contractors, and the myriad of subcontractors. Indeed, in some weapon system acquisitions, there may be several SPO's and prime contractors involved. These complex arrangements may require an "integrator" to get the primary task of technological interface accomplished. In most weapon system acquisitions, however, one organization usually acts as the integrator. This is generally the prime contractor.

When the prime contractor has responsibility for system integration, he is responsible for the design, development, production, and testing of the weapon system. Subsystems such as engines and avionics are furnished to the prime contractor by associate contractors, and these subsystems must be integrated to produce an overall system as

specified in the contract. The role of the SPO is generally one of surveillance, but it still has the authority and control to insure conformance to requirements. The lines of responsibility become clouded when Government-furnished equipment (GFE) is used or more than one prime contractor is involved (e.g. "The LRAM Interface Problem"). The problem is especially acute when it comes to allocating limited resources to a complete program (e.g. "The FF-1 Simulator Acquisition").

As mentioned earlier, some of these complex organizational arrangements may call for a separate integrating agency whose only concern is the interface of the complete weapon system. The role of the integrator is adequately covered in the literature (a recommended reading list appears at the end of the introduction). The particular cases in this section were developed with this particular role in mind.

The first case, "The LRAM Interface Problem," addresses the problem of integrating two separate acquisition programs into a single system. The students are asked to assume the role of advisors to the Aeronautical Systems Division (ASD) Commander. They are tasked to come up with recommendations as to the most effective organizational structure for acquiring an airborne missile that will be fitted to a new bomber which is currently under development. The problem is further complicated by the fact that the missile is being developed for aircraft presently in the inventory.

The second case, "The FF-1 Simulator Acquisition," focuses on the problems encountered in interfacing a simulator with its aircraft. Some of the problems encountered were intraorganizational as well as interorganizational. It also focuses on the concept of concurrent development of systems which is essentially a system integration planning problem: when should the interface of the simulator and aircraft take place? The case is a good example of how system integration pervades the entire acquisition process.

Suggested Readings

1) Berkwith, George J. "Collision at the Interface," Duns Review, Vol. 93 (March, 1969), pp. 64-67.

2) Lawrence, Paul R., and Jay W. Lorsch. "New Management Job: The Integrator," Harvard Business Review, Vol. 45 (November, 1967), pp. 142-151.

3) Mock, Captain Joseph W., USAF. "A Study of Systems Interfacing: A Case Description and Analysis of the AGM-69A/FB-111A Interface." Unpublished master's thesis, GSM/SM/70-13, School of Engineering, Air Force Institute of Technology (AU), Wright-Patterson AFB, Ohio (1970), pp. 16-41.

4) Wren, Daniel A. "Interface and Interorganizational Coordination," Academy of Management Journal, Vol. 10 (March, 1967), pp. 69-81.

II. THE LRAM INTERFACE PROBLEM

SUGGESTED CLASS PROCEDURE

1. Give each member of the class a copy of the case and divide the class into groups of 4 to 6 members.

2. Allow each group the rest of the class period to determine what their recommendations will be. Emphasize the fact that you are only interested in (1) their recommendations for an organizational structure, and (2) who should take responsibility for the integration effort (they should not get burdened with details).

3. At the next class meeting, select one group to brief their recommendations.

4. Have other class members critique the plan and offer alternative solutions.

Estimated student preparation time: 50 minutes.

Estimated class time required (student preparation and discussion): 100 minutes (two class periods).

Alternate Procedure

1. Give each member of the class a copy of the case for overnight analysis.

2. Instruct each student to prepare an outline of his plan and to be prepared to brief it for the next class period.

3. At the next class meeting, select one individual to brief his proposal.

4. Have other members of the class critique the plan and offer alternative solutions.

Estimated student preparation time: 60-90 minutes.

Estimated class time required: 50 minutes (one class period).

THE LRAM INTERFACE PROBLEM

The acquisition of a complex weapon system generally results in a multiplicity of interface management problems. These problems are not strictly limited to engineering; frequently the most difficult problem is integrating the management activities of the System Program Office (SPO), the prime contractor, and all of the subcontractors. Managing system integration is most frequently the responsibility of the prime contractor, but the SPO can become involved when Government-furnished equipment (GFE) is used. The dual responsibility aspect of GFE can cause problems when production of the weapon system begins (for example, see Appendix D).

Interface management problems can be multiplied when two separate programs are involved. An example of this is when an airborne missile is being developed concurrently (but not necessarily simultaneously) with a carrying aircraft. Early identification of all interfaces is necessary to prevent unnecessary modifications to either system or deviations from schedules. If the missile is being developed solely for use on the development aircraft, a separate program office may be established reporting directly to the aircraft SPO. When the missile is being developed for more than one aircraft, it may be necessary to have two separate program

offices. In this situation the two SPO's and their respective contractors need to come to some agreement as to how the interface will be handled. The problem still remains as to who will be responsible for the total integration effort. The Commander of Aeronautical Systems Division (ASD) is presently faced with just such a problem.

The Strategic Air Command (SAC) recently submitted a requirement for a long-range attack missile (LRAM) to be carried aboard its current bomber and the Advanced Manned Strategic Aircraft (AMSA) which is currently being developed. Shortly thereafter, the ASD Commander was requested to establish an initial cadre for the LRAM. He is aware that previous airborne missile programs were plagued by poor interface management which resulted in considerable cost growth for the missile and its associated aircraft. He feels such problems can be avoided if the right decisions are made early in the program. Therefore, he has tasked your group to come up with an interface management plan for the LRAM missile. Specifically, he is interested in what you think would be the most effective organizational structure, and which agency should be responsible for overall systems integration. Be prepared to brief your plan to him in the morning.

INSTRUCTOR GUIDANCE

One possible solution to this problem would be a dual SPO structure with an integrating staff agency having the responsibility for overseeing the interface of the two systems (Figure G.1). Since the missile is being developed for use on more than just the AMSA, this dual organizational structure might be more effective. The integrating agency could be headed by an officer of equivalent rank to the two system directors; the only responsibility of this agency would be the integration of the two systems. The system directors would still have control over their programs except for integration of the systems. This agency could better monitor the status of the whole program and could serve as an expeditor to keep communication and Engineering Change Proposal (ECP) information flowing between the two SPO's.

In any dual SPO structure, an ECP that affects one program will often affect the other. Improper coordination of these changes has led to schedule slippages and changes to the configuration of the other system. Such occurrences frequently result in contract changes that can be quite costly in nature. There is also the problem of who will fund which changes. For example, an avionics change in the missile guidance system may require a change in the interface with the aircraft; should the missile SPO fund the

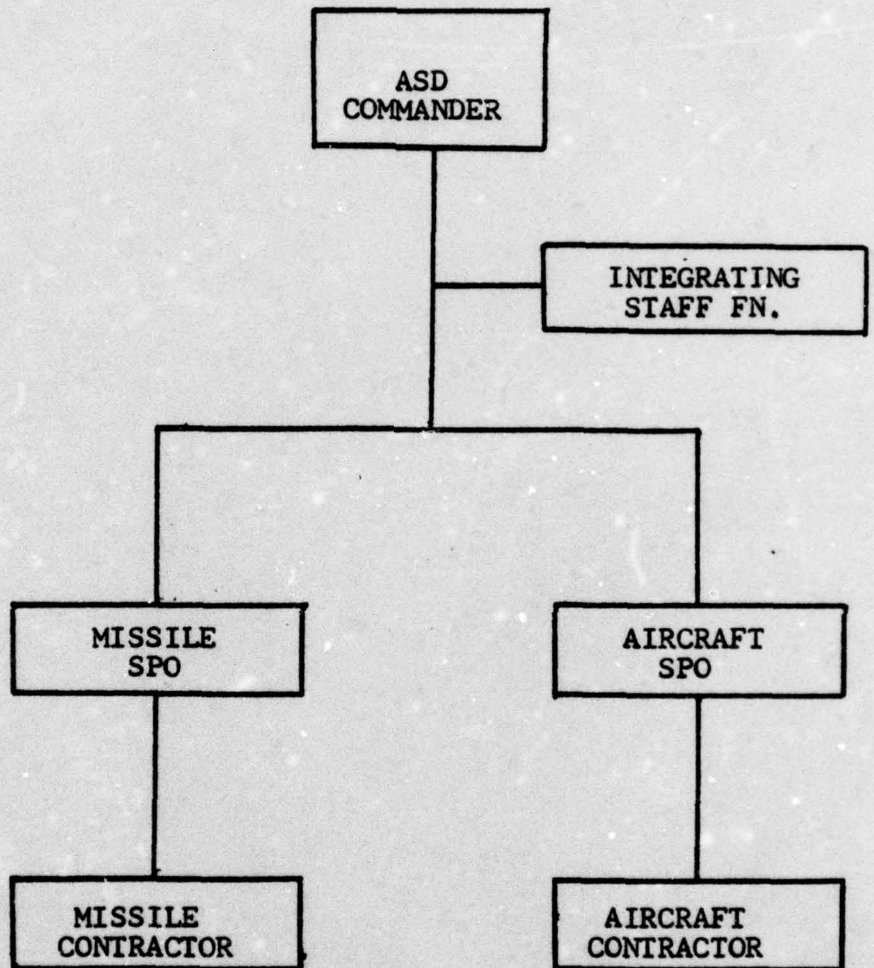

Figure G.1

PROPOSED ORGANIZATIONAL CHART

change for the aircraft? There are no pat answers to these problems, but a single agency whose only job is to monitor the integration may provide the necessary foresight to handle these problems.

Another possible problem area involves the relations between the two primary contractors. The aerospace industry is highly competitive with major weapon system contracts becoming fewer and fewer. It is difficult to get two contractors who may have been competitive bidders for the same program to work together. Ideally, the missile contractor would have a contract with the aircraft contractor, but the competitive environment makes this difficult. The contractor on each side of the interface is concerned more with the effectiveness of his particular system (a statement which can also be made about the SPO's). However, the effectiveness of the overall system is the prime objective and suboptimization is not desirable. Here again, the integrating agency can serve as the coordinator/expeditor for the complete system.

Other Comments

An integrating agency may be the answer for interface problems within ASD, but there may also be interface problems with aircraft that have transitioned to AFLC. The ASD Commander can serve as final arbiter for problems involving two SPO's, but who becomes the final arbiter for disagreements between AFLC and the missile SPO in the latter case? One answer may be to reunite AFLC and AFSC. These

two agencies were originally one command, and several serious proposals have been made in the past few years emphasizing the benefits of a single agency. This area (pro and con) could provide an interesting discussion topic if all points have been covered in the original problem.

Suggested Reading

1) Lawrence, Paul R., and Jay W. Lorsch. "New Management Job: The Integrator," Harvard Business Review, Vol. 45 (November, 1967), pp. 142-151.

2) Wren, Daniel A. "Interface and Interorganizational Coordination," Academy of Management Journal, Vol. 10 (March, 1967), pp. 69-81.

III. THE FF-1 SIMULATOR ACQUISITION (A)

SUGGESTED CLASS PROCEDURE

1. Give each member of the class a copy of the case for overnight analysis (estimated student preparation time: 60 minutes).

2. At the next class meeting, lead the class in a discussion of the case focusing on the student questions presented at the end of the case (estimated time: 50 minutes.

Alternate Procedure

1. Give each member of the class a copy of the case. Have them prepare a written analysis of the case focusing on the student questions presented at the end of the case (estimated time for analysis: 120 minutes).

THE FF-1 SIMULATOR ACQUISITION (A)[1]

The FF-1 simulator was acquired in conjunction with the Fancy Fighter aircraft (designated the FF-1), an extremely sophisticated multi-purpose fighter. The simulator acquisition was conducted in two increments: the first involved development of one prototype, and the second involved four production models.

Prototype Development

The requirement for a prototype flight trainer was included in the basic FF-1 contract. The purpose of a flight trainer is to simulate certain conditions of actual flight, particularly the characteristics of flight. The FF-1 simulator was to be used in the upgrading of student pilots and also to provide proficiency training for qualified pilots. This type of ground training would reduce the number of actual flying hours needed to support the FF-1 program. Although this requirement was recognized in the initial FF-1 contract negotiations, the complexities of the weapon system

[1]This case is based upon a thesis prepared by Major Billie Jatzen and Captain Gerald J. Schulke in partial fulfillment of the requirements for a Master of Science degree in Logistics Management at the Air Force Institute of Technology. The authors are responsible for the theoretical development, the conversion of the material into the case format, and the classroom support suggestions.

development and other priorities caused the requirement to be tabled until a later date.

Specific Dynamics (SD), the prime weapon system contractor, proceeded to prepare specifications and establish a list of potential sources for the simulator. Specifications were sent to the Air Force Systems Program Office (SPO) for approval. Pending receipt of specification approval, SD continued analysis of prospective sources and finally developed a Request for Proposal (RFP) which was subsequently sent to twelve prospective suppliers. Only two suppliers replied and were evaluated by SD for source selection purposes. Prior to SD's actual source selection, however, all source selection activity was halted pending the FF-1 SPO's re-evaluation of program requirements. During this period, the Air Force changed the pilot flight training simulator requirement to that of a mission simulator. The major difference between the two requirements was that the flight trainer was concerned with basic flight training, as previously explained, versus mission training. Mission training includes proficiency in the total operational environment of the aircraft. Specific Dynamics reversed its approach from the flight trainer and worked with the Air Force on the task of redefining the FF-1 Mission Simulator requirements. After a six month period, the mission requirements were defined and SD proceeded to develop general and performance specifications. General inquiries were sent to twenty-six companies which SD determined to have the interest

and capabilities to accomplish the required work. Only nine companies replied affirmatively. Advance copies of the specifications, pending Air Force approval, were sent to the nine companies for information and study purposes only. Specific Dynamics was again directed to stop work on the FF-1 Mission Simulator Program. Approximately a month later the stop work order was rescinded and SD was directed to proceed with the RFP. Specific Dynamics ascertained that the nine companies were still interested and capable of submitting a comprehensive proposal. However, shortly thereafter, only four companies advised that they would definitely submit proposals.

During this time frame, several technical changes were received by SD from the Air Force, including the requirement for an option provision in SD's contract allowing either the Air Force or SD to purchase production models directly from the successful development contractor. The option provision was a bid item. Specific Dynamics received approval on the specifications and issued RFP's to the four companies that indicated they would definitely respond to the RFP's. The RFP was for one prototype unit, a research, development, test, and engineering program. The RFP included: requirements for a transferable option-to-buy three additional units, based on the approved specifications and amendments provided; logistics spares provisioning; test support; and installation services at Podunk AFB, New Mexico. Three companies responded to the proposal: Smith Corporation,

Electronics Division; Right Corporation; and General Precision, Inc. (GP).

An exhaustive evaluation was performed by SD in determining which company was to receive the award. There were two general requirements which none of the responding companies met; space requirements and visual display requirements. After much consideration, SD decided to approach the Air Force with alternatives to reduce the requirements in these two general areas. Space requirements were not critical; however, the relaxation of the visual display requirement would significantly change the quality of realism desired in the mission simulator. Specific Dynamics determined that the visual display requirement was not within the present state of the art and therefore should be handled as a separate parallel program. With these limitations in mind, SD summarized the rankings of the proposals by major areas as follows:

	GP	Smith	Right
Composite Ranking	1	2	3
Cost	1	2	3
Technical	1	3	2
Management	acceptable	acceptable	acceptable
Delivery	acceptable	acceptable	acceptable
Other	acceptable	acceptable	acceptable

Cost of the basic proposals were as follows:

	GP	Smith	Right
Prototype Unit	$ 4,644,000	$ 5,071,000	$ 6,441,000
Production Units	7,799,000	7,687,000	10,499,000
Total (4 Units)	12,443,000	12,758,000	16,940,000

The proposals of General Precision and Smith were on a fixed price basis and Right's proposal was fixed price incentive. The time frame for exercising the transferable option was very short, 90 or 120 days, depending upon the company which received the award. The Air Force was pressed for time because of indecision about its training need. However, from the contractors' viewpoint, the time frame was reasonable and in conformance with good business practice. General Precision ultimately received the award from SD after approval from the Air Force.

Production Contract

The Air Force formalized its need for three more simulators in October of 1965. The Air Force was unable to exercise the option provision because the time frame for acceptance had expired. Later, a fourth production unit was added as requested by the Royal Australian Air Force (RAAF). The source, in both cases, was General Precision, Inc. The required delivery dates were established by Headquarters, United States Air Force as January 1967 for the first unit, March 1967 for the second unit, and July 1967 for the third unit. Production lead time had been conservatively estimated as fourteen months which indicated that a contract had to be placed immediately in order to minimize the delay to the government. Because of the time constraints, the Air Force determined that a letter contract was necessary. The Air Force specifications referenced specifications developed by SD under the weapon system contract

but not acquired by the Air Force. Therefore, primarily because of the lack of data, the Air Force had only one source of supply, General Precision. The letter contract was issued, effective 7 December 1965, for three FF-1 Mission Simulators, installation and checkout services, spare parts for Aerospace Ground Equipment, data, and updating/modification change kits. The letter contract was to be definitized within 180 days or before 40 percent completion of the suppliers and services required under the letter contract. A minimal amount of money was obligated allowing the contractor to start work immediately. Four amendments, primarily to increase funds, were made to the letter contract before the final contract was negotiated. Amendment number one also added spare parts for the prototype simulator being procured from SD. A key requirement in the contract was the "keep current" provision.

The "keep current" clause was included in the contract as a device to put pressure upon the contractor to produce simulators which would replicate the aircraft functions as closely as possible. Such a clause was feasible because GP was the subcontractor to SD for the prototype simulator, theoretically insuring close coordination. Disregarding the possible legal ramifications of binding a third party to the contract without consent, the idea seemed logical. However, this concept did not function as intended. Specific Dynamics was late on aircraft engineering changes (ECP's), thereby affecting the timeliness of simulator ECP's.

Negotiation Results

General Precision submitted its fixed priced incentive proposal on 15 February 1966 as required by the basic letter contract. Negotiations were concluded 18 November 1966.

The contractor's proposal under the option provision of Specific Dynamics was $7.799 million for three mission simulators and was valid until October 1965. Their proposal of 15 February 1966 was for $8.247 million, target price, revised to $7.994 million and later revised to $8.345 million. The $.5 million increase was attributable in part to Engineering Change Proposals incorporated by SD. The final negotiated price was $7.569 million. Deleting one time costs such as data items, the price for each simulator was $2.416 million.

Royal Australian Air Force Requirement

The RAAF requirement for one mission simulator was added to the contract by Contract Change Notice 2. In order to meet the RAAF's required delivery date, one USAF configured unit--unit #4--was changed to that of the RAAF's configuration requirement. Later, through negotiations, a replacement unit for the USAF was added to the contract to satisfy the initial Air Force requirement. Supplemental Agreement 4 definitized the requirement at a target price of $3.030 million, a unit increase of $.614 million. This cost increase was attributable to additional ECP's, and increased

labor and material costs. The pricing arrangement was the same (FPIF) as the basic contract.

Acquisition Problems

There were numerous changes to the system resulting from changes in the FF-1 aircraft, technical changes to the simulator, and changes in the mission simulator requirements. Examples of changes are: engine change; addition, deletion, relocation or redesign of performance indicators (gauges); and weapons release profiles respectively.

There were 273 ECP's submitted on the simulator contract; 177 were approved, and 96 were disapproved. ECP's funded under this contract numbered 116, the remainder were incorporated by the contractor at no additional cost to the government. There were 91 ECP's resulting from changes to the FF-1, and 25 ECP's peculiar to the simulator itself. In addition, most nonrecurring costs for changes were charged to the basic FF-1 contract. More changes would probably have been incorporated if the program had been funded differently.

The simulators were funded as a separate line item of the FF-1 program. A specific amount of dollars was allocated by the SPO Director. After the allotted funds were expended, funding for changes to the simulator were in direct competition with funding for changes to the aircraft. The existing mode of decision making within the Air Force dictated that aircraft changes would dominate if funding were available; therefore, when original funding was

exceeded, changes to the simulator acquiesced to changes in the aircraft. Secondarily, aircraft problems received immediate engineering support and prompt action on ECP's while such support for the simulator lagged. As a result, the simulator did not replicate the operation and function of the aircraft. The primary technical consideration prohibiting the replication was the visual projection system. The requirement for a 60 x 38 degree field through the forward windscreen was beyond the state of the art. After three million dollars were spent (funded under the basic contract), the visual projection requirement was deleted from the contract, thereby degrading performance.

Technical changes increased the contract price by \$2,991,358.00. The conversion of the fourth simulator to the RAAF version cost \$426,424.00. Modifications to the aircraft caused changes in the simulator, valued at \$738,602.00. Modifications peculiar to the simulator cost \$1,053,821.00. In addition, there were supplemental agreements which cost \$997,229.00 for aircraft induced and simulator peculiar changes. An additional \$201,706.00 was added for changes to data items and Government-furnished equipment (GFE).

Delivery date extensions resulted from incorporation of ECP's, availability of GFE, and the desires of the using command. Tactical Air Command (TAC) could not have the facilities ready for occupancy, nor could they have enough trained personnel to retrofit the eminent ECP's. In order

to avoid downtime and possible storage costs, the SPO and TAC decided to have General Precision install certain retrofit kits that TAC had originally planned to install after simulator delivery and installation. The primary advantage to be gained was immediate and continued use of the simulators after installation. The primary disadvantage was increased engineering costs. The buying activity therefore directed an ambitious modification schedule which caused the first simulator to be delivered one month late; the second and third units were two months late. In directing the modification, the Air Force recognized that the schedule would be difficult to meet because of critical vendor material deliveries: aircraft parts from SD and GFE.

In summary, technical and funding considerations had a profound effect upon the product received by the Air Force. The effect was upon performance, cost, and delivery. Mechanical operation of the system as delivered was good; however, the envisioned performance did not materialize. The necessary engineering changes to allow the simulator to mimic the FF-1 missions were identified, but funds were not available to incorporate all of the changes. Those changes that were installed increased the cost of the simulator by over one third. The acquisition accomplished the primary goal of having the simulators available concurrent with the delivery of the first FF-1 aircraft, but the "costs" may have exceeded the benefits.

<u>Student Questions</u>

1. Could the interface between the FF-1 SPO, Specific Dynamics, and General Precision have been more effective? What effect did the interface have on the program?

2. The FF-1 simulator was developed concurrently with the FF-1 aircraft. What impact did this have on the simulator acquisition?

3. Was the decision to develop the simulator and aircraft concurrently a valid one?

INSTRUCTOR GUIDANCE

The following are recommended answers to the student questions:

1. Could the interface between the FF-1 SPO, Specific Dynamics, and General Precision have been more effective? What effect did the interface have on the program?

Answer. The interface between the three organizations might have been more effective if General Precision had remained a subcontractor of Specific Dynamics. By awarding a separate contract to GP, the Government essentially took over the responsibility for system integration. Considering the fact that there was already a contract in existence with SD, the Government could have let that arrangement remain the same. The prime motivation behind the separate contract may have been to reduce costs (the initial negotiated price was $.425 million less than GP's initial bid to SD). The fact that the Government did not acquire design data under the prototype procurement made it difficult for them to adequately define the requirement to gain the benefits of a competitive bid. As far as sole source procurement is concerned, the Government did not appear to gain any significant cost advantage by awarding the contract to GP.

The interface did seem to adversely affect the simulator acquisition. The case indicates that SD was slow in

getting ECP's to GP as well as in sending parts to them. With a contractual arrangement between the two contractors for the production versions, one might speculate how responsive SD would have been to the demands of GP.

2. The FF-1 simulator was developed concurrently with the FF-1 aircraft. What impact did this have on the simulator acquisition?

Answer. The predominant impact was on the number of ECP's that were generated. The ECP's in turn affected the cost, schedule, and performance of the simulator. Managing ECP's is difficult enough when one system is involved; when one has to react to changes in the system that is to be simulated, it becomes an almost impossible task. It is even more difficult when there is a competition for the funds for these changes. Although the simulator is a part of the system as a whole, the tendency is to give the funds to the most visible part of the program.

3. Was the decision to develop the simulator and aircraft concurrently a valid one?

Answer. If one simply looks at the results of the acquisition, one would have to say "no." This is a simplistic answer, however, since one very rarely knows the outcomes of one's decision before it is made. One has to look at the costs and benefits of the situation. The only information that is given in any detail is the outcome of the decision and not any of the considerations that went into the decision in the first place. The question that

needs to be asked is: "Is it better to have a poor simulator than no simulator at all?" The case does not present a clear-cut answer to this question.

Additional Comments

This case is a good example of the complexities of the weapon system acquisition process. It is very difficult to focus on one problem without addressing several more. The one thing that it does bring out is that system development cannot succeed without total integration of organization, concepts, planning, and a realistic appraisal of available resources and capabilities. One has to question if these items were accomplished in this case.

APPENDIX H

TRANSFERRING SYSTEM RESPONSIBILITY

APPENDIX H

TABLE OF CONTENTS

I. INTRODUCTION

I. INTRODUCTION

The interface between Air Force Systems Command (AFSC), Air Force Logistics Command (AFLC), and the using command exists throughout the life of a weapon system. Although this interface is ubiquitous, it becomes most obvious when the prime responsibility for the management of the weapon system transfers from AFSC (specifically the System Program Office (SPO)) to AFLC and the using command. In the past, this transfer was referred to as "Transition" but is currently called "Program Management Responsibility Transfer (PMRT)." The designation is not the only thing that has changed.

Transition has frequently been a rather traumatic experience for all concerned. In the past, the "simple" transfer of management responsibility evolved into a long drawn out affair, primarily due to the way in which the responsibility for engineering (designated Air Force Engineering Responsibility (AFER)) was managed. The approach to AFER transfer (described in "AFER Transfer for the FF-1D Aircraft") resulted in a duplication of management effort for a single weapon system. This sharing of management responsibility frequently hindered configuration management by extending the process time for engineering changes. This resulted in a more costly weapon system.

As a result of these past problems in transferring management responsibility, PMRT was introduced in 1975. Basically, PMRT requires that the management of the weapon system transfer on a preplanned calendar date. This date is to be some time early in the production phase of the weapon system. The effect is that complete management responsibility (funding, engineering, etc.) will transfer on a date much earlier than under the older system, where Transition generally began after the production phase. It will require a detailed, coordinated planning effort by the SPO, AFLC, and the using command to make PMRT work.

As yet, no program has gone through a PMRT date so that the effectiveness of the concept can not be judged. What seems clear, however, is that the particular management problems associated with transferring management responsibility will remain the same. The only thing that will be different is the approach used to solve those problems.

The two cases in this section focus on some of the transfer problems experienced in the past. The first case, "The FF-1 Simulator Acquisition (B)," addresses the problems associated with transferring a support system to the using command prior to the arrival of the first aircraft. The problem is complicated by the fact that the using command is not prepared to receive the support equipment. The second case, "AFER Transfer for the FF-1D Aircraft," addresses some of the problems that resulted from the piecemeal approach to transferring engineering responsibility. The questions after

the case allow the student to identify the problems of the past and to "forecast" some of the problems to be expected in the future.

II. THE FF-1 SIMULATOR ACQUISITION (B)

SUGGESTED CLASS PROCEDURE

Distribute the case at the beginning of the class and allow the students 20 minutes to analyze the case. Select one student to present his solution and rationale to the class followed by a class critique and discussion (total estimated time for student preparation and discussion: 50 minutes).

THE FF-1 SIMULATOR ACQUISITION (B)[1]

The FF-1 Mission Simulator had been developed concurrently with the FF-1 aircraft so that the simulator would be operational when the first aircraft was delivered to the using command, Tactical Air Command (TAC). The hoped for benefits of this concurrent development were a reduction in actual aircraft training flight hours, resulting in an extended operational life for the aircraft. The concurrent development led to a large number of engineering changes (ECP's) in the aircraft which had to be incorporated into the simulator as well. It soon became apparent that all of the ECP's could not be accomplished before the simulator's scheduled delivery date. Therefore, the SPO and TAC agreed to a retrofit plan whereby the SPO would fund the engineering changes and TAC personnel would be trained to install them.

Six months prior to the scheduled delivery date of the first simulator, TAC notified the SPO that the facilities for the simulators would not be completed in time for delivery and installation of the first simulator. Despite the

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[1]This case is based upon a thesis prepared by Major Billie Jatzen and Captain Gerald J. Schulke in partial fulfillment of the requirements for a Master of Science degree in Logistics Management at the Air Force Institute of Technology. The authors are responsible for the theoretical development, the conversion of the material into the case format, and the classroom support suggestions.

delay, TAC still requested that the simulators be delivered in a condition that would make them immediately usable with a minimum amount of down time for retrofits.

The SPO was faced with three alternatives: have General Precision (the simulator contractor) store the simulators, make delivery of the simulators to the Air Force for storage, or have General Precision perform additional work on the simulators. A cost estimate revealed that the least costly alternative was to have the Air Force store the simulators. The costliest alternative was to have General Precision perform additional retrofits on the simulators before delivery. Since the simulator acquisition had already experienced cost growth in excess of 25 percent, the SPO was hesitant to adopt any alternative that would add to the cost problem. An additional factor was that the simulator could not be expected to mimic the aircraft exactly, since all of the required ECP's could not be funded under any of the alternatives.

Considering the factors given in the case, which alternative would you recommend the SPO take? Be prepared to present and defend your recommendation.

INSTRUCTOR GUIDANCE

The actual decision made in the case was to have General Precision install the retrofit kits rather than have the Air Force do it. It proved to be an ambitious program that caused the delivery of the simulators to be delayed an additional one to two months. Although the contractor's engineering cost was significantly greater than the estimated Air Force installation cost (the magnitude of the difference was not given in the case), the SPO decided to go with the costlier alternative. The primary rationale appeared to be the expected loss of training. Indeed, the whole program had been geared to delivering the simulator to TAC so it could be used for training pilots in time to make use of the new aircraft when delivered. It would have probably seemed incongruous if the SPO had done anything different.

As far as the information provided in the case, the student should consider how big a difference in costs the different alternatives would provide. A small difference in costs versus the possible benefits of receiving a usable simulator earlier could impact on one's decision. However, the most important question the student should address is what impact the particular alternative would have on the entire program, not necessarily just its impact on the

acquisition of the simulator itself. Failure to address this point could lead one to a suboptimal decision.

Additional Comments

This case is only one example of how the SPO and using command interface. The actual interface occurs throughout the acquisition of a particular weapon system and not strictly at the "transition phase" of the system where the weapon is being provided to the user. Perhaps a more accurate description of this particular interface is that it represents one of the "political" constraints which the SPO must operate within.

III. AFER TRANSFER FOR THE FF-1D AIRCRAFT

SUGGESTED CLASS PROCEDURE

Distribute the case to the students at the beginning of class and allow them 10-15 minutes to analyze it. Lead a classroom discussion of the questions following the case (recommended time for student preparation and classroom discussion: 50 minutes).

AFER TRANSFER FOR THE FF-1D AIRCRAFT

Air Force Engineering Responsibility (AFER), which is the accountability for weapon system integrity of design and performance, normally transferred from Air Force Systems Command (AFSC) to Air Force Logistics Command (AFLC) at the end of the production phase for the weapon system. This transfer was normally accomplished by series, so that AFLC could have AFER for the "A" model of a particular aircraft and AFSC have AFER for the "D" model. In addition, AFER for the same series could be split between the two commands if there were exceptions listed in the Engineering Transfer Package (ETP). Such exceptions occurred when a particular subsystem or component had not reached its specified level of performance prior to the AFER transfer date. This situation frequently prevented the System Program Office (SPO) from reducing their personnel requirements.

One example of this exception problem occurred in the AFER transfer for the FF-1D. Specifically, the offensive avionics subsystem (designated the SS-2) was listed as an exception in the FF-1D ETP. The SS-2 avionics package had a mean-time-between-failure (MTBF) some 30 percent less than called for in the specifications. The engineering changes (ECP's) that would bring the SS-2 up to specifications had been identified, but the cost would be in excess of $3

million. Neither the FF-1 SPO nor AFLC had the funds available to purchase the changes. Since the SS-2 avionics did not meet its specifications and there were no funds available to procure the necessary changes, the SS-2 did not meet the existing criteria for AFER transfer. Therefore, AFER for the FF-1D was split between the two commands, with AFSC retaining responsibility for the SS-2, while AFLC and the using command were responsible for the FF-1D as a whole.

Student Questions

1. Do you agree with the decision not to transfer SS-2 AFER to AFLC? Be prepared to defend your position.

2. What advantages/disadvantages would there be to establishing a firm "program transfer date" prior to the end of the production phase?

3. "Weapon system acquisition could be more effectively managed if AFLC and AFSC were combined into a single Logistics Command." What is your position on this statement? What alternative structure (if any) would be better than the present system?

INSTRUCTOR GUIDANCE

Possible Answers to Student Questions

1. Do you agree with the decision not to transfer SS-2 AFER to AFLC? Be prepared to defend your position.

Answer. The decision not to transfer SS-2 AFER was in accordance with current directives, but one could reasonably disagree with the decision. Since the funding for the changes comes from the same appropriation category (aircraft procurement), it really makes no difference who funds the changes. An additional factor is that any modifications would more than likely be performed at depot level (i.e. they would probably not go back to the contractor's plant). AFLC would be able to control the scheduling of the modifications if they had AFER. If the modifications were funded, AFSC would now have a say in the scheduling of aircraft into the depot. Therefore, from a management control standpoint, it would be better for AFLC to have accepted the transfer of the SS-2 avionics package.

Other factors bearing on the decision: (1) the SPO is already in close contact with the contractor and there might be some loss in continuity if the system were transferred; (2) the engineers at the gaining Air Logistics Center (ALC) may not have been "up to speed" on the problems of the SS-2.

2. What advantages/disadvantages would there be to establishing a firm "program transfer date" prior to the end of the production phase?

Answer. This question is pointed to the new Air Force policy governing transfer of management responsibility, called Program Management Responsibility Transfer (PMRT). A specific date, as early as possible in the production phase, must be established during the full scale development phase of the acquisition life cycle. This date then becomes a program milestone which can only be changed by HQ USAF based on a joint recommendation of the Commanders, AFSC and AFLC. Some of the possible advantages of establishing a firm date in the production phase are:

(1) It will allow AFLC to make decisions that will affect the entire life of the aircraft. Since they are the ones who have to live with those decisions, they should be allowed to make them.

(2) It will force both AFLC and AFSC to plan and coordinate the transfer of the weapon system; this appears to have been lacking in the past.

(3) By establishing a firm date, AFLC and AFSC can budget more effectively.

(4) There will be less of an overlap in manpower between AFLC and AFSC which should save money for the Air Force.

Some of the possible disadvantages are:

(1) AFLC is structured along functional lines which may make it difficult to manage production.

(2) Currently, approval for ECP's rests at AFLC Hq. level; some change would have to be made in these procedures if ECP's need to be expedited.

(3) Plans call for the Deputy Program Manager for Logistics (DPML) to assume the responsibility for weapon system development at the time of transfer. His position in AFLC is not nearly as powerful as that of the SPO director in AFSC. The "straight line to the top" may be missing at a crucial time in the development of the weapon system.

3. "Weapon system acquisition could be more effectively managed if AFLC and AFSC were combined into a single Logistics Command." What is your position on this statement? What alternative structure (if any) would be better than the present system?

Answer. The Air Force is the only one of the services which divides the acquisition and support of its weapon systems between two major commands. In fact, the Air Force at one time accomplished both the AFSC and the AFLC missions in one command, the old Air Material Command. Since the Air Force is going to a life cycle approach, it would seem natural to have a single command manage the weapon system from "cradle to grave." The present structure does appear to lead to duplication in managing weapon systems. There probably is some waste of resources, which, under the current

political and economic environments, cannot be tolerated. A single "super" command may be too big to manage, but some alternate solutions have been proposed.

One alternative solution[1] would be to form an independent program office for major weapon acquisitions. This organization would be composed of people from both AFLC and AFSC and would exist for the life of the weapon system. In the beginning the personnel mix would favor AFSC and, as the system matured, the mix would favor AFLC. The SPO director would switch from an AFSC person to an AFLC person as the system matured: the deputy position would always be held by a representative from the other command. This structure might be difficult to manage, however, since there would always be a question of who the SPO director is responsible to.

Additional Comments

This case addressed some of the problems that were encountered in the "old" system. Just because we are operating under a new set of rules does not mean the old situation will not recur. The problems seem to remain the same. It is only the way we handle them that seems to change.

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[1]This alternative was suggested by Captain Rominger in his thesis "A Study of the Program Management Responsibility Transfer Process for the F-16" (unpublished master's thesis, GSM/SM/75S-8, School of Engineering, Air Force Institute of Technology (AU), Wright-Patterson AFB, Ohio, 1975), p. 82.

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